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ATTORNEY DOCKET NO. 10030187-1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Xie, et al

Serial No.: 10/655,946

Examiner: Sherman, Stephen

Filing Date: September 4, 2003

Group Art Unit: 2629

Title: An Apparatus for Optical Navigation

COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Sir:

Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on herewith

The fee for filing this Appeal Brief is (37 CFR 1.17(c)) **$500.00.**

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

☐ (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)(1)-(5)) for the total number of months checked below:

☐	one month	$ 120.00
☐	two months	$ 450.00
☐	three months	$1020.00
☐	four months	$1590.00

☐ The extension fee has already been filled in this application.

☒ (b) Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account **50-3718** the sum of $500.00 . At any time during the pendency of this application, please charge any fees required or credit any overpayment to Deposit Account **50-3718** pursuant to 37 CFR 1.25.

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Date of Facsimile: Feb. 27, 2007

Typed Name: Calvin Ward

Signature: _____

Respectfully submitted,

Xie, et al

By _____

Calvin B. Ward
Attorney/Agent for Applicant(s)

Reg. No. 30,896

Date: Feb. 27, 2007

Telephone No. (925) 855-0413

Rev 12/05 (ApiBrief)

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PATENT APPLICATION
Attorney Docket: 10030187-1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF APPEALS

Applicant:	Xie, et al
Serial No.:	10/655,946
Filed:	9/4/2003
For:	An Apparatus for Optical Navigation
Group Art Unit:	2629
Examiner:	Sherman, Stephen

BRIEF FOR APPELLANT

Commissioner For Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an appeal from the decision of the Primary Examiner dated 12/5/2006, finally rejecting Claims 1, 2, 4-11, 13-18, 20-21 in the above-identified patent application.

I. REAL PARTY IN INTEREST

The real party in interest is Avago Technologies, LTD. having an address as indicated below.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to appellant, the appellant's legal representative, or assignee which will directly affect, or be directly affected by, or have a bearing on, the Board's decision in this pending appeal.

III. STATUS OF THE CLAIMS

Claims 1, 2, 4-11, 13-18, 20-21 are currently pending in the above-identified patent application. In the Office Action dated 12/5/2006, the Examiner rejected Claims 1, 2, 4-11, 13-18, 20-21 and indicated that the Action was final.

IV. STATUS OF AMENDMENTS

An amendment under 37 C.F.R. 1.116 was filed on 1/15/2007. In an advisory action dated 2/2/2007, the Examiner indicated that the amendment would be entered on filing an appeal. The attached claims reflect this amendment.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention is directed to an optical navigation apparatus. With respect to Claims 1 and 2, refer to Figure 2A and the discussion thereof that begins on page 9 at line 3 of the present application. The apparatus, having a surface 180 with an aperture 185, can be moved over an illuminated surface 206 that has a detectable texture. An integral optical motion detection circuit 210, including a single detector that acquires images at a specified rate, is optically coupled to that texture. The circuit includes an image processor that compares two images from the imaging detector to calculate motion signals representing position changes of the navigation apparatus relative to the illuminated surface, along two axes. No integral illumination source is required. Claim 2 specifies an additional optical element integral to the apparatus that achieves the optical coupling required, such as the lens 208 shown in Figure 2A. Claim 4 relates to the inclusion of a supplemental light source for the purpose of supplementing the illumination of the textured surface when the optical detection circuit determines that the illumination is insufficient. Such a supplemental light source is shown as element 222 in Figure 2B. Claim 5 relates to the inclusion of an internal power source, such as element 150, shown in Figure 1B.

Claims 6-8 relate to the use of the optical navigation apparatus over two different types of illuminated surfaces with correspondingly different detectable textures. Claim 6 concerns the use of the shadow mask of a CRT as the texture; such a mask is shown at 404 in Figures 4A and 4B. Claim 7 is directed to the use of the diffuser plate 442 of a liquid crystal display as the texture; diffuser plate 442 is shown in Figure 4C. Claim 8 concerns the use of the pixel matrix of a liquid crystal display as the texture. A pixel matrix of this type is shown as element 434 in Figure 4C; Claims 9-10 relate to details of implementations that use an

overlaid semi-transparent layer to provide the detectable texture. An example of such a layer is shown as element 442 in Figure 4C. Claim 10 is directed to embodiments in which the overlaid layer provides absolute position information that can be used to provide the location of the detector on the surface as opposed to the change in location from the previous location.

Claims 11 and 13-16 relate to implementations of the basic apparatus described above as electronic devices that are designed for navigation over a display screen. Figure 2B and Figure 3 show the core features detailed in Claim 11, including a surface 180 with an aperture 185, moveable over the screen of a display, here represented by element 206 which has a detectable texture when illuminated, an integral optical element such as 206 close to the aperture, receiving light from the textured surface, and an optical motion detection circuit 210. The circuit has a single detector 304, acquires images at a specified rate, a single image at a time, and includes an image processor 306 that produces motion signals indicating the motion of the apparatus relative to the detectable texture. These signals indicate the change in location along two axes, and are produced by comparing two images. No integral illumination source is required for the image acquisition. Claim 13 specifies the inclusion of an internal power source, such as that shown as element 150 in Figure 1B. Claims 14-17 relate to different detectable textures. Claim 14 concerns the use of a shadow mask of a CRT, shown as element 404 in Figure 4B. Claim 15 concerns the use of a diffuser plate on a liquid crystal display, shown as element 442 in Figure 4C, while Claim 16 concerns the use of the pixel matrix of a liquid crystal display, shown as element 434 in Figure 4C. Claim 18 specifies the feature of an overlaid layer, such as element 442 in Figure 4C, providing absolute position information.

With respect to Claims 20-21, refer to Figures 5A and 5B and the discussion thereof that begins on Page 15 at line 10. Claim 20 describes a method for optical navigation of an electronic device over an illuminated surface. The method, outlined in the flowchart of Figure 5A, involves acquiring two frames, using these to determine the relative change in position, along two axes, between the device and the illuminated surface, by computing correlation values for the two frames. The position shift is predicted and the corresponding motion signal is output. Claim 21 concerns the addition of supplemental illumination if it is determined that the surface illumination is otherwise insufficient for frame acquisition. The process outline is given in the flowchart of Figure 5B.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Rejection of Claims 1, 2, 11 and 20 under 35 U.S.C. 102(b) as being anticipated by Liou (US 5,086,197).

Rejection of Claims 4 and 21 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Lauffenburger *et al* (hereafter "Lauffenburger") (US 6,963,059).

Rejection of Claims 5, 8, 13 and 16 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Mumford (US 6,377,249).

Rejection of Claims 6 and 14 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Minn (US 4,565,947).

Rejection of Claims 7 and 15 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Ditzik (US 5,771,039).

Rejection of Claims 9, 10, 17, and 18 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Burns (US 5,442,147).

VII. ARGUMENT

A. Examiner's Burden under 35 U.S.C. 102

The Examiner has the burden of showing by reference to the cited art each claim limitation in the reference. Anticipation under 35 U.S.C. 102 requires that each element of the claim in issue be found either expressly or inherently in a single prior art reference. In re King, 231 USPQ 136, 138 (Fed. Cir. 1986); Kalman v. Kimberly-Clark Corp., 218 USPQ 781, 789 (Fed. Cir. 1983). The mere fact that a certain thing may result from a given set of circumstances is not sufficient to sustain a rejection for anticipation. *Ex parte Skinner*, 2 USPQ2d 1788, 1789 (BdPatApp&Int 1986). "When the PTO asserts that there is an explicit or implicit teaching or suggestion in the prior art, it must indicate where such a teaching or suggestion appears in the reference" (*In re* Rijckaert, 28 USPQ2d, 1955, 1957).

Under the doctrine of inherency, if an element is not expressly disclosed in a prior art reference, the reference will still be deemed to anticipate a subsequent claim if the missing element "is necessarily present in the thing described in the reference" Cont'l Can Co. v. Monsanto Co., 948 F.2d 1264, 1268, 20 USPQ2d 1746, 1749(Fed. Cir. 1991). "Inherent anticipation requires that the missing descriptive material is 'necessarily present,' not merely probably or possibly present, in the prior art." Trintec Indus., Inc. v. Top-U.S.A. Corp., 295 F.3d 1292, 1295, 63 USPQ2d 1597, 1599(Fed. Cir. 2002) (quoting In re Robertson, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999)).

B. Examiner's Burden under 35 U.S.C. 103

To sustain a rejection under 35 U.S.C. 103, the Examiner must show that the combined references teach each of the elements of the claim or that there is some motivation in the art for altering one of the teachings to arrive at the combined set of teachings. "The mere fact that a reference could be modified to produce the patented invention would not make the modification obvious unless it is suggested by the prior art." (*Libbey-Owens-Ford v. BOC Group*, 4 USPQ 2d 1097, 1103). In addition, the Examiner must show that there is some motivation in the art that would cause someone of ordinary skill to combine the references, and that in making the combination, there was a reasonable expectation of success. Where the claimed subject matter has been rejected as obvious in view of a combination of prior art references, a proper analysis under section 103 requires, *inter alia*, consideration of two factors: (1) whether the prior art would have suggested to those of ordinary skill in the art that they should make the claimed composition or device, or carry out the claimed process; and (2) whether the prior art would also have revealed that in so making or carrying out, those of ordinary skill would have a reasonable expectation of success. Both the suggestion and the reasonable expectation of success must be founded in the prior art, not in the applicant's disclosure. *In re Vaeck*, 20 USPQ2d 1438, 1442(CAFC 1991).

C. Essence of Examiner's Argument as to the Teachings of Liou

The Examiner's rejections are all based on Liou, either alone or in combination with one or more additional references. These rejections are based on the Examiner's assertion that Liou teaches 5 limitations of the claims. If the Examiner is incorrect in the Examiner's reading of Liou, the anticipation rejections cannot be sustained. Furthermore, the

obviousness rejections are also flawed in that these rejections assume that the elements in question are present in Liou, as the secondary references do not supply the missing teachings. To avoid repeating the details of the arguments with respect to the Examiner's reading of Liou, Applicant will discuss these limitations in detail here. The 5 limitations in question are as follows.

1. The Examiner maintains that Liou teaches a device in which the displacement of the apparatus over the illuminated surface is determined from two images of the surface, taken by a single detector consisting of 4 photodetectors. The Examiner maintains that the outputs of these 4 photodetectors form an image and points to Applicant statements that an imaging array can be constructed from a plurality of individual imaging elements.

First, the fact that an imaging array can be formed from a collection of photodetectors does not imply that every collection of photodetectors that receives light from a scene is an imaging array that forms an image of a scene. Since the term image is not specifically defined in the present application, one must look to what someone of ordinary skill would interpret that term to mean. In this regard, it should be noted that the various definitions of an "image" all require that the image is a representation of a thing that closely resembles that thing (see Concise Oxford Dictionary or American Heritage Dictionary). The "thing" being imaged in Liou is a two-dimensional grid of lines crossing at right angles. The lines in each dimension have a spacing and width such that the spaces between the lines are equal to the widths of the lines. The 4 signals generated by the apparatus of Liou at any given time do not resemble a grid of lines crossing at right angles and having a spacing and width such that the spaces between the lines are equal to the widths of the lines. In fact, 4 pixels could not represent such a scene.

Even if one were to interpret the 4 photodiode signals of Liou as being some form of "imaging array", the arrangement taught in Liou corresponds to two detectors that form two one-dimensional "images", and hence, any two "images" taken by either detector taught in Liou can only provide information along one axis. Liou treats the outputs of each pair of photodetectors separately. One pair provides an output equivalent to a conventional one-dimensional encoder operating in one direction, and the other pair provides an output equivalent to a conventional one-dimensional encoder operating in the orthogonal direction

(column 3, lines 65-66). Hence, the signals are not pixels in a two-dimensional image, but rather the results of a mathematical operation performed on an image of the surface to provide signals that are function in the same manner as a pair of conventional encoders.

In fact, the Examiner points to the comparison of the outputs from one pair of detectors taken at different times as corresponding to computing a correlation value between two images. Hence, the Examiner admits that each pair of detectors is a separate "imaging array" even in the interpretation put forth by the Examiner.

2. The Examiner maintains that Liou teaches a device having an integral optical motion detection circuit. Applicant submits that the circuit taught in Liou generates a signal independent of the motion of the imaging means relative to the grid pattern. The circuit of Liou requires an external circuit to convert that signal to one that detects motion, and hence, the motion detection circuit is not integral to the apparatus of Liou.

The Examiner attempts to overcome this problem by stating that the word "integral" does not exclude an "external" circuit outside the device. Applicant respectfully disagrees. The first definition of the word "integral" in the American Heritage Dictionary is "Essential or necessary for completeness; constituent"; the second is "Possessing everything essential; entire". Liou does not teach a circuit with any of these characteristics.

The issue is not whether Liou teaches a system that excludes an external circuit but whether Liou teaches the integral limitation of the claim either explicitly or inherently. The Examiner has not pointed to any explicit teaching in Liou of an integral motion detector. Hence, the Examiner must be arguing that the teaching is inherent in the reference. In this regard, it is sufficient to note that the device of Liou or a device using the device of Liou does not have to detect motion. Liou teaches a form of encoder head that operates on a particular code surface. Encoders provide an indication of the position of the head relative to the surface without generating a signal indicative of the motion of the head over the surface. While one could generate a motion signal from the outputs provided by the apparatus of Liou, such a signal is not required, and hence, the teaching is not necessarily present as required by the doctrine of inherency.

3. The Examiner maintains that Liou teaches a device that acquires images at a specified rate. The Examiner has not pointed to any explicit teaching in Liou of a circuit that acquires images at a specified rate. Instead, the Examiner argues that the teaching is inherent in the reference. The Examiner states that Liou satisfies the limitation since Liou must operate at some operating frequency. That is, the device taught in Liou forms "images" at regular intervals.

The Examiner's argument rests on the premise that every device samples at a finite fixed frequency to provide its output. This is clearly not the case, since numerous examples of devices that provide a signal that changes continuously in time are known. At the quantum limit, one could argue that the signal changes in discrete steps as individual electrons leave the apparatus. But even in this case, the steps would not be characterized by a regular time interval.

Furthermore, Liou teaches a device that outputs 4 signals on a continuous basis. There is no teaching that the signals are output at a predetermined frequency. Furthermore, since the signals are intended to duplicate the output of two conventional encoder heads. Such encoders do not sample the signals. While a device receiving the signals might sample the signals at a fixed frequency, there is no such teaching in Liou and such sampling is not required. Furthermore, an incorrect sampling rate could lead to a position error if regular sampling strategy were utilized in the apparatus of Liou. For example, consider the case in which the encoding head moved by a distance equal to the period in the grid pattern, i.e., the distance between the centers of two adjacent lines. In this case, there is no change in the state of the outputs from the photodetectors. Hence, the change in position would not be detected.

4. The Examiner maintains that Liou teaches a method in which two image frames are shifted along one axis and correlation values are computed to determine the actual position shift of a device over an illuminated surface. The Examiner's argument depends on the Examiner's definition of correlation value as being any value that is a measure of the relationship between two variables, and since Liou teaches comparing the current values of the output of the detectors to previous values, the Examiner maintains that Liou is computing a correlation value.

The relevant claim limitation requires that two frames be formed, one of the frames shifted with respect to the other frame, and then a correlation value be computed. The Examiner has not pointed to any shifting of frames. At best, one could argue that Liou teaches comparing two corresponding pixels in two frames taken at different times, but without shifting.

5. The Examiner maintains that the apparatus of Liou does not require an integral illumination source, since Liou teaches one embodiment in which the light source is outside of one of the components of the apparatus. Applicant submits that Figure 1 shows, and the text specifically describes (column 2 lines 44-45), the apparatus taught by Liou as **including** a light source, namely element 10 or element 10'. Applicant submits that the fact that the source 10' is positioned outside one component of the apparatus does not mean that it is not an integral part of the apparatus.

D. Rejection of Claims 1, 2, 4-11, 13-18, 20-21

1. Rejection of Claims 1-2, 11 and 20 under 35 U.S.C. 102(b) as being anticipated by Liou.

First, with regard to the limitation in Claim 1 requiring an integral optical motion detection circuit, the Examiner states that the "claim never states this limitation". Applicant must dispute this statement, as Claim 1 clearly specifies "an optical motion detection circuit integral to said apparatus".

Second, Claims 1, 2 and 11 require limitations 1, 2, 3, and 5, discussed above. Applicant maintains that Liou does not teach these four limitations, and hence, Liou does not anticipate these Claims.

Finally, Claim 20 requires limitations 1, 4, and 5, discussed above. Applicant maintains that Liou does not teach these three limitations, and hence, Liou does not anticipate Claim 20.

2. Rejection of Claims 4 and 21 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Lauffenburger.

Claim 4 depends from Claim 1, and Claim 21 depends from Claim 20. In addition to the limitations of the base claims, these claims require that the apparatus include a supplemental light source that provides additional illumination of the surface in response to the optical motion detection circuit detecting insufficient illumination of the surface.

In the Examiner's first rejection of these claims on this grounds, the Examiner admitted that Liou does not teach such a supplemental light source, and the Examiner looked to Lauffenburger as providing the missing teachings. When Applicant pointed out that Lauffenburger taught changing the intensity of a single light source rather than teaching the inclusion of a supplemental light source, the Examiner switched his argument to state that Lauffenburger was only cited to show that changing the intensity of the light source was known to have advantages. The Examiner then went on to assert that one of the two light sources taught in Liou could be the supplemental light source that was turned on in response to a determination that there was insufficient illumination. As best Applicant can understand the Examiner's current grounds in this rejection, Applicant assumes that the Examiner is arguing that one would be motivated to change the light sources in the apparatus of Liou to arrive at an apparatus that satisfies the limitations of Claims 4 and 21. Three separate changes would be required. First, a circuit that determines that there is insufficient illumination would need to be added to the apparatus of Liou. Second, the apparatus of Liou would need to be modified to include both of the light sources rather than one or the other as now taught in Liou. Third, the apparatus would be modified to run on only one of the two light sources unless the new circuit determined that the light levels were too low. The circuit would then cause the second light source to be activated.

First, Applicant repeats the arguments made above with respect to Claims 1 and 20 from which Claims 4 and 21 depend, respectively. Applicant submits that the teachings discussed above as missing from Liou are not provided by Lauffenburger. Hence, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 4 and 21, independent of the additional limitations of Claims 4 and 21.

Second, Claims 4 and 21 require "supplemental" and "additional" illumination respectively, in the cases where the optical motion detection circuit detects that there is insufficient illumination of the surface. The Examiner maintains that since Liou teaches two light sources, one of the light sources could be regarded as a supplemental light source for the other. Initially, it should be noted that Liou does not teach an embodiment in which both light sources are present simultaneously under any circumstance. Liou teaches two separate embodiments, one a light source on the same side of the pattern as the detectors, and one utilizing the light source on the other side of the pattern from the detectors.

With respect to the first alteration, it should be noted that the target pattern illuminated in the Liou apparatus is known at the time the apparatus is designed and remains fixed throughout the lifetime of the apparatus. Hence, the designer merely provides a light source of required brightness that is incorporated at the time the apparatus is manufactured. Hence, absent some teaching that this light source would change intensity over time by an amount that would cause the accuracy of the encoding system taught therein to significantly decrease, there is no motivation for including an additional circuit that measures the amount of light reaching the photodetectors and determines whether or not the detected light is sufficient. The Examiner has not pointed to any teaching in the references that this light source would change in this manner.

With respect to the second alteration, the Examiner is asserting that given that one would make the first alteration, the apparatus of Liou would be further modified to include both of the light sources discussed above with one of the light sources being the supplemental light source that is turned on when there is too little light, as opposed to changing the intensity of the light source in each of the embodiments taught in Liou as suggested by Lauffenburger. The Examiner does not point to any teaching that would cause someone to choose this alternative as opposed to altering the intensity of the one light source.

In fact, such a two light source embodiment would, at best, be less effective than either of the embodiments discussed in Liou, and would probably be inoperative. For an embodiment to function with transmissive lighting, i.e., the light source on the opposite side of the grid pattern from the photodetectors, the grid pattern must consist of opaque lines separated by clear spaces that transmit the light. The clear spacings appear bright to an

apparatus viewing the illuminated pattern. If a second light source is now used to illuminate the pattern from above, the only light that reaches the photodetectors from this second source is the light that is reflected from the top surface of the opaque lines, since the light that strikes the clear areas is transmitted toward the other light source. Hence, the opaque lines appear bright, not the transparent spaces when viewed with light from the second light source. Hence, the second light source reduces the contrast between the lines and the spacings between the lines that was created by the first light source.

With respect to the third alteration, the Examiner has not pointed to any teaching in the art, as opposed to the present application, that a supplemental light source would be advantageous is curing a lack of light from the primary light source. The cited reference teaches using a light source that has an adjustable output intensity and adjusting that output intensity in response to insufficient light.

Accordingly, Applicant submits that the Examiner has not pointed to any teaching in the art that would cause someone to make both of these modifications, and if anything, the modifications would not provide any advantages in the system taught in Liou. Accordingly, there are additional grounds for allowing Claims 4 and 21.

3. Rejection of Claims 5, 8, 13 and 16 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Mumford.

Rejections of Claims 5 and 13.

Claim 5 depends from Claim 1, and Claim 13 depends from Claim 11. Applicant repeats the arguments made above with respect to the missing teachings in Liou. The Examiner has not pointed to any teachings in Mumford that provide the missing teachings in Liou. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 5 and 13.

Rejections of Claim 8 and 16.

Claim 8 depends from Claim 1, and Claim 16 depends from Claim 11. Applicant repeats the arguments made above with respect to the missing teachings in Liou. The Examiner has not pointed to any teachings in Mumford that provide the missing teachings in Liou. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 8 and 16.

In addition, Claims 8 and 16 include the additional limitation that the light source is a liquid crystal display and that the detectable texture is the pixels of this display. The Examiner admits that Liou does not teach this additional limitation and looks to Mumford as providing the missing teaching.

Mumford teaches a light pen that operates on a liquid crystal display. The position of the pen is determined by applying a particular color pattern on the display and then detecting the color of the pixel over which the pen is positioned. The Examiner looks to Mumford as teaching that the illuminated surface that is detected in Liou could be a liquid crystal display. The Examiner maintains that one would alter the illuminated surface in Liou to include a liquid crystal display to provide a light pen system in which the writing/detection tablet is not physically separated from the display screen.

First, it should be noted that there is a fundamental problem in using the apparatus of Liou to determine the position of the reading head on a surface that displays another scene whether that surface is a liquid crystal display or a cathode ray tube, as discussed below. The system of Liou assumes that the image being processed by the photodiodes and related optics is a specific two-dimensional grid pattern consisting of lines and spaces in which the spaces between the lines are the same width as the lines. If another pattern is also present on the display, the photodiodes and optics must process a pattern that is the sum of the two patterns. This compound pattern no longer meets the criterion required for the navigation pattern. Hence, the only possible combination that might produce an operable device is one in which the grid pattern is generated on the display and no other pattern is generated with it. This is equivalent to replacing the printed pattern taught in Liou with a display screen that generates the same pattern. The Examiner has not pointed to any advantage of such a device over that taught in Liou.

Second, replacing the illuminated grid pattern in Liou with a liquid crystal display does not provide any advantage in the device taught in Liou. If anything, such a substitution would increase the cost and decrease the accuracy of detection. The encoder of Liou depends on a specific pattern on the illuminated surface. The accuracy of position measurement depends on the accuracy of the pattern. The pattern in Liou is limited only by the accuracy of the patterns that can be generated using photolithography. The accuracy of a pattern that can be generated on a liquid crystal display is limited by the size of the pixels on that display. The available pixel sizes are much larger than then the smallest feature that can be printed using photolithography.

In addition, even if one could provide a liquid crystal display of the same accuracy as the printed patterns used in Liou, nothing would be accomplished other than an increase in the cost of the encoder system taught in Liou. One would merely be replacing a line pattern printed on a reflective or transmissive boundary with a liquid crystal display in which the pattern displayed is constant over time. The cost of the liquid crystal display is orders of magnitude higher than the printed pattern. Accordingly, there is no reasonable expectation of success in making the substitution suggested by the Examiner. Hence, there are additional grounds for allowing Claims 8 and 16.

4. Rejection of Claims 6 and 14 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Minn.

Claim 6 depends from Claim 1, and Claim 14 depends from Claim 11. Applicant repeats the arguments made above with respect to the missing teachings in Liou. The Examiner has not pointed to any teachings in Minn that provide the missing teachings in Liou. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 6 and 14.

In addition, Claims 6 and 14 include the additional limitation that the light source is a cathode ray tube and that the detectable texture is the shadow mask on the cathode ray tube. The Examiner admits that Liou does not teach this additional limitation and looks to Minn as providing the missing teaching. The Examiner maintains that it would have been obvious to one of ordinary skill in the art to incorporate the teachings of Minn in the teachings of Liou to

have a device that reads the shadow mask of a cathode ray tube so that it can be used directly on the display surface of a cathode ray tube.

First, as noted above, the combination of the apparatus of Liou with a display screen is only operable if the display screen is limited to displaying the grid pattern taught in Liou. Any additional information would cause the apparatus of Liou to be inoperative with respect to providing its navigation function.

Second, Minn teaches a light pen that operates on the surface of a cathode ray tube having a shadow mask; however, the light pen of Minn does not detect the shadow mask. The light pen of Minn determines the position of the light pen on the tube surface by reading out the x and y coordinates of the spot on the cathode ray tube when the light pen detects light during the normal raster scanning of the tube surface. This is a conventional light pen arrangement. Minn is directed to providing a better phosphor composition for the surface of the tube. There is no teaching in Minn of reading the shadow mask. In fact, the scheme taught therein operates on cathode ray tubes that lack any form of shadow mask.

Third, the apparatus of Liou depends on the detected pattern being constantly illuminated over the entire portion of the pattern that is viewed by the photodiodes. A cathode ray tube only illuminates one point at a time. Hence, the resultant apparatus would not function without additional modifications.

Fourth, the Examiner has not pointed to any teaching that the shadow mask of a conventional CRT provides the grid pattern required by the apparatus of Liou. A shadow mask on a CRT typically consists of circular holes in an opaque layer. This is not the grid pattern required by Liou. Hence, the shadow mask does not inherently have a property that would allow the apparatus of Liou to function using that mask as the grid pattern.

Hence, there are additional grounds for allowing Claims 6 and 14.

5. Rejection of Claims 7 and 15 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Ditzik.

Claim 7 depends from Claim 1, and Claim 15 depends from Claim 11. Applicant repeats the arguments made above with respect to the missing teachings in Liou. The Examiner has not pointed to any teachings in Ditzik that provide the missing teachings in Liou. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 7 and 15.

In addition, Claims 7 and 15 include the additional limitation that the light source is a liquid crystal display and that the detectable texture is the diffuser plate of the liquid crystal display. The Examiner admits that Liou does not teach this additional limitation and looks to Ditzik as providing the missing teaching. The Examiner maintains that it would have been obvious to one of ordinary skill to incorporate the teachings of Ditzik in the teachings of Liou to have a liquid crystal display with a diffuser plate as the illuminated surface in order to utilize a commonly used display device and to have a diffuser to evenly distribute the backlight over the screen area.

First, as noted above, the combination of the apparatus of Liou with a display screen is only operable if the display screen is limited to displaying the grid pattern taught in Liou. Any additional information would cause the apparatus of Liou to be inoperative with respect to providing its navigation function.

Second, Applicant must disagree with the Examiner's reading of Ditzik. There is no teaching in Ditzik that the optional diffuser plate taught therein has a detectable texture, no less that such a texture is visible from the front side of the display in a manner that would allow it to function as the pattern required in the apparatus of Liou. For example, a plate consisting of scattering particles having dimensions of the order of the wavelength of the light from the light source will provide the desired diffusion property without presenting a texture that can be imaged. In fact, the goal of a diffuser plate is blur any detactable pattern present in the light source that is illuminating the liquid crystal display. Furthermore, Liou requires a particular detectable pattern, i.e., a grid pattern of lines in which the width of the lines is equal to space between the lines. If such a pattern was executed at a scale that could be detected in the manner required by the apparatus of Ditzik, it would not provide the diffusion function.

Third, the diffusion plate taught in Ditzik is behind the liquid crystal panel. It is only visible through those pixels that are open at any given time. The pixels of the panel are opened and closed at times that depend on the image being displayed. Hence, there is no stable pattern that is visible through the liquid crystal display. As noted above, the apparatus of Liou requires that the pattern in the region being illuminated be illuminated in a continuous manner so that the photodetectors can generate the required signals and compare the signals to one another. Hence, even if one were to put the appropriate grid pattern on the diffuser plate in question, the resultant apparatus would not operate in the intended manner. Hence, there is no reasonable expectation of success in making the alterations suggested by the Examiner. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 7 and 15.

6. Rejection of Claims 9, 10, 17, and 18 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Burns (US 5,442,147).

Claims 9 and 10 are dependent from Claim 1, and Claims 17 and 18 are dependent from Claim 11. These claims require that the detectable texture be on a semi-transparent layer that is overlaid over the illuminated surface. Applicant repeats the arguments made above with respect to the missing teachings in Liou with respect to Claims 1 and 11. The Examiner has not pointed to any teachings in Burns that provide the missing teachings. Hence, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 9, 10, 17 and 18.

Claims 10 and 18 further require that the semi-transparent layer provide unique positioning information that provides absolute position information for the apparatus relative to the illumination surface. The Examiner looks to Burns for the missing teachings. Applicant submits that the issue is not whether Burns teaches a semi-transparent layer with a unique pattern for absolute navigation, but whether such a pattern could be used in the apparatus of Liou and still have a functioning device. The apparatus taught by Liou requires a repetitive pattern, namely, a rectilinear grid having a specific relationship between the width of the dark and light regions, in order to function. The pattern in the layer taught by Burns would not comply with this requirement, and so the combination would not be operative.

Furthermore, to provide absolute position information, the pattern must change as one moves from position to position on the surface. However, the apparatus of Liou is incapable

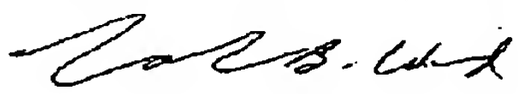
of detecting such changes. The apparatus of Liou only outputs 4 logic signals, two that provide an indication of the position in each dimension and the direction of motion since the last change in the state of the signals. Hence, the encoder of Liou is constrained to providing relative changes in position, and could not provide an absolute position indication without further alterations. Accordingly, there are additional grounds for allowing Claims 10 and 17.

VIII. CONCLUSION

Appellant respectfully submits that for the reasons of fact and law argued herein, the decision of the Examiner in finally rejecting Claims 1, 2, 4-11, 13-18, 20-21 should be reversed.

I hereby certify that this paper (along with any others attached hereto) is being sent via facsimile to fax number: 571-273-8300

Respectfully Submitted,



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APPENDIX

THE CLAIMS ON APPEAL:

1. An apparatus for optical navigation comprising:

a surface comprising an aperture, said surface configured to be moveable against an illuminated surface having a detectable texture;

an optical motion detection circuit integral to said apparatus and optically coupled to said detectable texture of said illuminated surface, said optical motion detection circuit comprising a single detector for acquiring images of said surface at a specified rate, said detector acquiring a single image at a time, and comprising an image processor producing motion signals indicative of motion of said surface relative to said detectable texture of said illuminated surface, wherein said motion signals are produced by comparing two said images and comprise a change in location in a first axis and a change in location in a second axis, wherein said optical motion detection circuit is operable to detect said detectable texture without requiring an integral illumination source.

2. The apparatus as recited in Claim 1 further comprising an optical element integral to said apparatus, said optical element proximate said aperture and receiving light from said detectable texture of said illuminated surface, said optical element operable to optically couple said optical motion detection circuit integral to said detectable texture of said illuminated surface.

4. The apparatus as recited in Claim 1 further comprising a supplemental light source operable to provide additional illumination onto said illuminated surface in response to said optical motion detection circuit detecting insufficient illumination of said illumination surface.

5. The apparatus as recited in Claim 1 further comprising an internal power source for providing power to said apparatus.

6. The apparatus as recited in Claim 1 wherein said illuminated surface is a cathode ray tube and wherein said detectable texture is a shadow mask of said cathode ray tube.

7. The apparatus as recited in Claim 1 wherein said illuminated surface is a liquid crystal display and wherein said detectable texture is a diffuser plate of said liquid crystal display.

8. The apparatus as recited in Claim 1 wherein said illuminated surface is a liquid crystal display and wherein said detectable texture comprises pixels of said liquid crystal display.

9. The apparatus as recited in Claim 1 wherein said illuminated surface is overlaid with a semi-transparent layer comprising said detectable texture.

10. The apparatus as recited in Claim 9 wherein said semi-transparent layer comprises unique positioning information providing absolute position information of said apparatus relative to said illuminated surface.

11. An electronic device for optical navigation on a display screen, said electronic device comprising:

a surface comprising an aperture, said surface configured to be moveable against a display screen having a detectable texture when illuminated;

an optical element integral to said electronic device, said optical element proximate said aperture and receiving light from said detectable texture when illuminated; and

an optical motion detection circuit integral to said electronic device and optically coupled by said optical element to said detectable texture of said display screen said optical motion detection circuit comprising an single detector for acquiring images of said surface at a specified rate, said detector acquiring a single image at a time, and comprising an image processor producing motion signals indicative of motion of said surface relative to said detectable texture of said display screen when illuminated, wherein said motion signals are

produced by comparing two said images and comprise a change in location in a first axis and a change in location in a second axis, wherein said optical motion detection circuit is operable to detect said detectable texture without requiring an integral illumination source.

13. The electronic device for optical navigation on a display screen as recited in Claim 11 further comprising an integral power source for providing power to said electronic device.

14. The electronic device for optical navigation on a display screen as recited in Claim 11 wherein said detectable texture is a shadow mask of a cathode ray tube.

15. The electronic device for optical navigation on a display screen as recited in Claim 11 wherein said detectable texture is a diffuser plate of a liquid crystal display.

16. The electronic device for optical navigation on a display screen as recited in Claim 11 wherein said detectable texture are pixels of a liquid crystal display.

17. The electronic device for optical navigation on a display screen as recited in Claim 11 wherein said display screen is overlaid with a semi-transparent layer comprising said detectable texture.

18. The electronic device for optical navigation on a display screen as recited in Claim 17 wherein said semi-transparent layer comprises unique positioning information providing absolute position information of said electronic device relative to said display screen.

20. A method for optical navigation on an illuminated surface using an electronic device, said method comprising:

acquiring a first frame from said illuminated surface at a single detector of said electronic device, such that said electronic device does not require an internal illumination source to provide illumination to said illuminated surface;

acquiring a second frame at said single detector from said illuminated surface:

determining a change in position in a first axis and in a second axis of said electronic device relative to said illuminated surface based on said first frame and said second frame,

wherein said determining a change in position comprises:

computing correlation values for said first frame and said second frame after said second frame has been shifted along one of said axes to determine an indication of movement of said electronic device from said first frame to said second frame;

predicting a shift in position from said first frame based on said correlation values: and

outputting a motion signal indicating said shift in position.

21. The method as recited in Claim 20 further comprising:

determining whether illumination provide by said illuminated surface sufficient for said acquiring said first frame; and

provided said illumination provided by said illuminated surface is not sufficient for said acquiring said first frame, providing additional illumination onto said illuminated surface.

22. A method for optical navigation on an illuminated surface using an electronic device, said method comprising:

acquiring a first frame from said illuminated surface at a single detector of said electronic device, such that said electronic device does not require an internal illumination source to provide illumination to said illuminated surface;

acquiring a second frame at said single detector from said illuminated surface;

determining a change in position in a first axis and in a second axis of said electronic device relative to said illuminated surface based on said first frame and said second frame;

wherein said determining a change in position comprises;

computing correlation values for said first frame and said second frame, said correlation values indicating movement of said electronic device from said first frame to said second frame;

predicting a shift in position from said first frame based on said correlation values; and

outputting a motion signal indicating said shift in position, said method further comprising:

determining whether illumination provided by said illuminated surface interferes with said acquiring said first frame; and

provided said illumination provided by said illuminated surface interferes with said acquiring said first frame, providing interference reducing illumination onto said illuminated surface; and

filtering said illumination such that said electronic device can acquire said first frame using said interference reducing illumination.

Evidence Appendix

none

Related Proceedings Appendix

none

PATENT APPLICATION
Attorney Docket: 10030187-1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF APPEALS

Applicant:	Xie, et al
Serial No.:	10/655,946
Filed:	9/4/2003
For:	An Apparatus for Optical Navigation
Group Art Unit:	2629
Examiner:	Sherman, Stephen

BRIEF FOR APPELLANT

Commissioner For Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an appeal from the decision of the Primary Examiner dated 12/5/2006, finally rejecting Claims 1, 2, 4-11, 13-18, 20-21 in the above-identified patent application.

I. REAL PARTY IN INTEREST

The real party in interest is Avago Technologies, LTD. having an address as indicated below.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to appellant, the appellant's legal representative, or assignee which will directly affect, or be directly affected by, or have a bearing on, the Board's decision in this pending appeal.

III. STATUS OF THE CLAIMS

Claims 1, 2, 4-11, 13-18, 20-21 are currently pending in the above-identified patent application. In the Office Action dated 12/5/2006, the Examiner rejected Claims 1, 2, 4-11, 13-18, 20-21 and indicated that the Action was final.

IV. STATUS OF AMENDMENTS

An amendment under 37 C.F.R. 1.116 was filed on 1/15/2007. In an advisory action dated 2/2/2007, the Examiner indicated that the amendment would be entered on filing an appeal. The attached claims reflect this amendment.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention is directed to an optical navigation apparatus. With respect to Claims 1 and 2, refer to Figure 2A and the discussion thereof that begins on page 9 at line 3 of the present application. The apparatus, having a surface 180 with an aperture 185, can be moved over an illuminated surface 206 that has a detectable texture. An integral optical motion detection circuit 210, including a single detector that acquires images at a specified rate, is optically coupled to that texture. The circuit includes an image processor that compares two images from the imaging detector to calculate motion signals representing position changes of the navigation apparatus relative to the illuminated surface, along two axes. No integral illumination source is required. Claim 2 specifies an additional optical element integral to the apparatus that achieves the optical coupling required, such as the lens 208 shown in Figure 2A. Claim 4 relates to the inclusion of a supplemental light source for the purpose of supplementing the illumination of the textured surface when the optical detection circuit determines that the illumination is insufficient. Such a supplemental light source is shown as element 222 in Figure 2B. Claim 5 relates to the inclusion of an internal power source, such as element 150, shown in Figure 1B.

Claims 6-8 relate to the use of the optical navigation apparatus over two different types of illuminated surfaces with correspondingly different detectable textures. Claim 6 concerns the use of the shadow mask of a CRT as the texture; such a mask is shown at 404 in Figures 4A and 4B. Claim 7 is directed to the use of the diffuser plate 442 of a liquid crystal display as the texture; diffuser plate 442 is shown in Figure 4C. Claim 8 concerns the use of the pixel matrix of a liquid crystal display as the texture. A pixel matrix of this type is shown as element 434 in Figure 4C; Claims 9-10 relate to details of implementations that use an

overlaid semi-transparent layer to provide the detectable texture. An example of such a layer is shown as element 442 in Figure 4C. Claim 10 is directed to embodiments in which the overlaid layer provides absolute position information that can be used to provide the location of the detector on the surface as opposed to the change in location from the previous location.

Claims 11 and 13-16 relate to implementations of the basic apparatus described above as electronic devices that are designed for navigation over a display screen. Figure 2B and Figure 3 show the core features detailed in Claim 11, including a surface 180 with an aperture 185, moveable over the screen of a display, here represented by element 206 which has a detectable texture when illuminated, an integral optical element such as 206 close to the aperture, receiving light from the textured surface, and an optical motion detection circuit 210. The circuit has a single detector 304, acquires images at a specified rate, a single image at a time, and includes an image processor 306 that produces motion signals indicating the motion of the apparatus relative to the detectable texture. These signals indicate the change in location along two axes, and are produced by comparing two images. No integral illumination source is required for the image acquisition. Claim 13 specifies the inclusion of an internal power source, such as that shown as element 150 in Figure 1B. Claims 14-17 relate to different detectable textures. Claim 14 concerns the use of a shadow mask of a CRT, shown as element 404 in Figure 4B. Claim 15 concerns the use of a diffuser plate on a liquid crystal display, shown as element 442 in Figure 4C, while Claim 16 concerns the use of the pixel matrix of a liquid crystal display, shown as element 434 in Figure 4C. Claim 18 specifies the feature of an overlaid layer, such as element 442 in Figure 4C, providing absolute position information.

With respect to Claims 20-21, refer to Figures 5A and 5B and the discussion thereof that begins on Page 15 at line 10. Claim 20 describes a method for optical navigation of an electronic device over an illuminated surface. The method, outlined in the flowchart of Figure 5A, involves acquiring two frames, using these to determine the relative change in position, along two axes, between the device and the illuminated surface, by computing correlation values for the two frames. The position shift is predicted and the corresponding motion signal is output. Claim 21 concerns the addition of supplemental illumination if it is determined that the surface illumination is otherwise insufficient for frame acquisition. The process outline is given in the flowchart of Figure 5B.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Rejection of Claims 1, 2, 11 and 20 under 35 U.S.C. 102(b) as being anticipated by Liou (US 5,086,197).

Rejection of Claims 4 and 21 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Lauffenburger *et al* (hereafter "Lauffenburger") (US 6,963,059).

Rejection of Claims 5, 8, 13 and 16 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Mumford (US 6,377,249).

Rejection of Claims 6 and 14 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Minn (US 4,565,947).

Rejection of Claims 7 and 15 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Ditzik (US 5,771,039).

Rejection of Claims 9, 10, 17, and 18 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Burns (US 5,442,147).

VII. ARGUMENT

A. Examiner's Burden under 35 U.S.C. 102

The Examiner has the burden of showing by reference to the cited art each claim limitation in the reference. Anticipation under 35 U.S.C. 102 requires that each element of the claim in issue be found either expressly or inherently in a single prior art reference. In re King, 231 USPQ 136, 138 (Fed. Cir. 1986); Kalman v. Kimberly-Clark Corp., 218 USPQ 781, 789 (Fed. Cir. 1983). The mere fact that a certain thing may result from a given set of circumstances is not sufficient to sustain a rejection for anticipation. *Ex parte Skinner*, 2 USPQ2d 1788, 1789 (BdPatApp&Int 1986). "When the PTO asserts that there is an explicit or implicit teaching or suggestion in the prior art, it must indicate where such a teaching or suggestion appears in the reference" (*In re* Rijckaert, 28 USPQ2d, 1955, 1957).

Under the doctrine of inherency, if an element is not expressly disclosed in a prior art reference, the reference will still be deemed to anticipate a subsequent claim if the missing element "is necessarily present in the thing described in the reference" Cont'l Can Co. v. Monsanto Co., 948 F.2d 1264, 1268, 20 USPQ2d 1746, 1749(Fed. Cir. 1991). "Inherent anticipation requires that the missing descriptive material is 'necessarily present,' not merely probably or possibly present, in the prior art." Trintec Indus., Inc. v. Top-U.S.A. Corp., 295 F.3d 1292, 1295, 63 USPQ2d 1597, 1599(Fed. Cir. 2002) (quoting In re Robertson, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999)).

B. Examiner's Burden under 35 U.S.C. 103

To sustain a rejection under 35 U.S.C. 103, the Examiner must show that the combined references teach each of the elements of the claim or that there is some motivation in the art for altering one of the teachings to arrive at the combined set of teachings. "The mere fact that a reference could be modified to produce the patented invention would not make the modification obvious unless it is suggested by the prior art." (*Libbey-Owens-Ford v. BOC Group*, 4 USPQ 2d 1097, 1103). In addition, the Examiner must show that there is some motivation in the art that would cause someone of ordinary skill to combine the references, and that in making the combination, there was a reasonable expectation of success. Where the claimed subject matter has been rejected as obvious in view of a combination of prior art references, a proper analysis under section 103 requires, *inter alia*, consideration of two factors: (1) whether the prior art would have suggested to those of ordinary skill in the art that they should make the claimed composition or device, or carry out the claimed process; and (2) whether the prior art would also have revealed that in so making or carrying out, those of ordinary skill would have a reasonable expectation of success. Both the suggestion and the reasonable expectation of success must be founded in the prior art, not in the applicant's disclosure. *In re Vaeck*, 20 USPQ2d 1438, 1442(CAFC 1991).

C. Essence of Examiner's Argument as to the Teachings of Liou

The Examiner's rejections are all based on Liou, either alone or in combination with one or more additional references. These rejections are based on the Examiner's assertion that Liou teaches 5 limitations of the claims. If the Examiner is incorrect in the Examiner's reading of Liou, the anticipation rejections cannot be sustained. Furthermore, the

obviousness rejections are also flawed in that these rejections assume that the elements in question are present in Liou, as the secondary references do not supply the missing teachings. To avoid repeating the details of the arguments with respect to the Examiner's reading of Liou, Applicant will discuss these limitations in detail here. The 5 limitations in question are as follows.

1. The Examiner maintains that Liou teaches a device in which the displacement of the apparatus over the illuminated surface is determined from two images of the surface, taken by a single detector consisting of 4 photodetectors. The Examiner maintains that the outputs of these 4 photodetectors form an image and points to Applicant statements that an imaging array can be constructed from a plurality of individual imaging elements.

First, the fact that an imaging array can be formed from a collection of photodetectors does not imply that every collection of photodetectors that receives light from a scene is an imaging array that forms an image of a scene. Since the term image is not specifically defined in the present application, one must look to what someone of ordinary skill would interpret that term to mean. In this regard, it should be noted that the various definitions of an "image" all require that the image is a representation of a thing that closely resembles that thing (see Concise Oxford Dictionary or American Heritage Dictionary). The "thing" being imaged in Liou is a two-dimensional grid of lines crossing at right angles. The lines in each dimension have a spacing and width such that the spaces between the lines are equal to the widths of the lines. The 4 signals generated by the apparatus of Liou at any given time do not resemble a grid of lines crossing at right angles and having a spacing and width such that the spaces between the lines are equal to the widths of the lines. In fact, 4 pixels could not represent such a scene.

Even if one were to interpret the 4 photodiode signals of Liou as being some form of "imaging array", the arrangement taught in Liou corresponds to two detectors that form two one-dimensional "images", and hence, any two "images" taken by either detector taught in Liou can only provide information along one axis. Liou treats the outputs of each pair of photodetectors separately. One pair provides an output equivalent to a conventional one-dimensional encoder operating in one direction, and the other pair provides an output equivalent to a conventional one-dimensional encoder operating in the orthogonal direction

(column 3, lines 65-66). Hence, the signals are not pixels in a two-dimensional image, but rather the results of a mathematical operation performed on an image of the surface to provide signals that are function in the same manner as a pair of conventional encoders.

In fact, the Examiner points to the comparison of the outputs from one pair of detectors taken at different times as corresponding to computing a correlation value between two images. Hence, the Examiner admits that each pair of detectors is a separate "imaging array" even in the interpretation put forth by the Examiner.

2. The Examiner maintains that Liou teaches a device having an integral optical motion detection circuit. Applicant submits that the circuit taught in Liou generates a signal independent of the motion of the imaging means relative to the grid pattern. The circuit of Liou requires an external circuit to convert that signal to one that detects motion, and hence, the motion detection circuit is not integral to the apparatus of Liou.

The Examiner attempts to overcome this problem by stating that the word "integral" does not exclude an "external" circuit outside the device. Applicant respectfully disagrees. The first definition of the word "integral" in the American Heritage Dictionary is "Essential or necessary for completeness; constituent"; the second is "Possessing everything essential; entire". Liou does not teach a circuit with any of these characteristics.

The issue is not whether Liou teaches a system that excludes an external circuit but whether Liou teaches the integral limitation of the claim either explicitly or inherently. The Examiner has not pointed to any explicit teaching in Liou of an integral motion detector. Hence, the Examiner must be arguing that the teaching is inherent in the reference. In this regard, it is sufficient to note that the device of Liou or a device using the device of Liou does not have to detect motion. Liou teaches a form of encoder head that operates on a particular code surface. Encoders provide an indication of the position of the head relative to the surface without generating a signal indicative of the motion of the head over the surface. While one could generate a motion signal from the outputs provided by the apparatus of Liou, such a signal is not required, and hence, the teaching is not necessarily present as required by the doctrine of inherency.

3. The Examiner maintains that Liou teaches a device that acquires images at a specified rate. The Examiner has not pointed to any explicit teaching in Liou of a circuit that acquires images at a specified rate. Instead, the Examiner argues that the teaching is inherent in the reference. The Examiner states that Liou satisfies the limitation since Liou must operate at some operating frequency. That is, the device taught in Liou forms "images" at regular intervals.

The Examiner's argument rests on the premise that every device samples at a finite fixed frequency to provide its output. This is clearly not the case, since numerous examples of devices that provide a signal that changes continuously in time are known. At the quantum limit, one could argue that the signal changes in discrete steps as individual electrons leave the apparatus. But even in this case, the steps would not be characterized by a regular time interval.

Furthermore, Liou teaches a device that outputs 4 signals on a continuous basis. There is no teaching that the signals are output at a predetermined frequency. Furthermore, since the signals are intended to duplicate the output of two conventional encoder heads. Such encoders do not sample the signals. While a device receiving the signals might sample the signals at a fixed frequency, there is no such teaching in Liou and such sampling is not required. Furthermore, an incorrect sampling rate could lead to a position error if regular sampling strategy were utilized in the apparatus of Liou. For example, consider the case in which the encoding head moved by a distance equal to the period in the grid pattern, i.e., the distance between the centers of two adjacent lines. In this case, there is no change in the state of the outputs from the photodetectors. Hence, the change in position would not be detected.

4. The Examiner maintains that Liou teaches a method in which two image frames are shifted along one axis and correlation values are computed to determine the actual position shift of a device over an illuminated surface. The Examiner's argument depends on the Examiner's definition of correlation value as being any value that is a measure of the relationship between two variables, and since Liou teaches comparing the current values of the output of the detectors to previous values, the Examiner maintains that Liou is computing a correlation value.

The relevant claim limitation requires that two frames be formed, one of the frames shifted with respect to the other frame, and then a correlation value be computed. The Examiner has not pointed to any shifting of frames. At best, one could argue that Liou teaches comparing two corresponding pixels in two frames taken at different times, but without shifting.

5. The Examiner maintains that the apparatus of Liou does not require an integral illumination source, since Liou teaches one embodiment in which the light source is outside of one of the components of the apparatus. Applicant submits that Figure 1 shows, and the text specifically describes (column 2 lines 44-45), the apparatus taught by Liou as **including** a light source, namely element 10 or element 10'. Applicant submits that the fact that the source 10' is positioned outside one component of the apparatus does not mean that it is not an integral part of the apparatus.

D. Rejection of Claims 1, 2, 4-11, 13-18, 20-21

1. Rejection of Claims 1-2, 11 and 20 under 35 U.S.C. 102(b) as being anticipated by Liou.

First, with regard to the limitation in Claim 1 requiring an integral optical motion detection circuit, the Examiner states that the "claim never states this limitation". Applicant must dispute this statement, as Claim 1 clearly specifies "an optical motion detection circuit integral to said apparatus".

Second, Claims 1, 2 and 11 require limitations 1, 2, 3, and 5, discussed above. Applicant maintains that Liou does not teach these four limitations, and hence, Liou does not anticipate these Claims.

Finally, Claim 20 requires limitations 1, 4, and 5, discussed above. Applicant maintains that Liou does not teach these three limitations, and hence, Liou does not anticipate Claim 20.

2. Rejection of Claims 4 and 21 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Lauffenburger.

Claim 4 depends from Claim 1, and Claim 21 depends from Claim 20. In addition to the limitations of the base claims, these claims require that the apparatus include a supplemental light source that provides additional illumination of the surface in response to the optical motion detection circuit detecting insufficient illumination of the surface.

In the Examiner's first rejection of these claims on this grounds, the Examiner admitted that Liou does not teach such a supplemental light source, and the Examiner looked to Lauffenburger as providing the missing teachings. When Applicant pointed out that Lauffenburger taught changing the intensity of a single light source rather than teaching the inclusion of a supplemental light source, the Examiner switched his argument to state that Lauffenburger was only cited to show that changing the intensity of the light source was known to have advantages. The Examiner then went on to assert that one of the two light sources taught in Liou could be the supplemental light source that was turned on in response to a determination that there was insufficient illumination. As best Applicant can understand the Examiner's current grounds in this rejection, Applicant assumes that the Examiner is arguing that one would be motivated to change the light sources in the apparatus of Liou to arrive at an apparatus that satisfies the limitations of Claims 4 and 21. Three separate changes would be required. First, a circuit that determines that there is insufficient illumination would need to be added to the apparatus of Liou. Second, the apparatus of Liou would need to be modified to include both of the light sources rather than one or the other as now taught in Liou. Third, the apparatus would be modified to run on only one of the two light sources unless the new circuit determined that the light levels were too low. The circuit would then cause the second light source to be activated.

First, Applicant repeats the arguments made above with respect to Claims 1 and 20 from which Claims 4 and 21 depend, respectively. Applicant submits that the teachings discussed above as missing from Liou are not provided by Lauffenburger. Hence, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 4 and 21, independent of the additional limitations of Claims 4 and 21.

Second, Claims 4 and 21 require "supplemental" and "additional" illumination respectively, in the cases where the optical motion detection circuit detects that there is insufficient illumination of the surface. The Examiner maintains that since Liou teaches two light sources, one of the light sources could be regarded as a supplemental light source for the other. Initially, it should be noted that Liou does not teach an embodiment in which both light sources are present simultaneously under any circumstance. Liou teaches two separate embodiments, one a light source on the same side of the pattern as the detectors, and one utilizing the light source on the other side of the pattern from the detectors.

With respect to the first alteration, it should be noted that the target pattern illuminated in the Liou apparatus is known at the time the apparatus is designed and remains fixed throughout the lifetime of the apparatus. Hence, the designer merely provides a light source of required brightness that is incorporated at the time the apparatus is manufactured. Hence, absent some teaching that this light source would change intensity over time by an amount that would cause the accuracy of the encoding system taught therein to significantly decrease, there is no motivation for including an additional circuit that measures the amount of light reaching the photodetectors and determines whether or not the detected light is sufficient. The Examiner has not pointed to any teaching in the references that this light source would change in this manner.

With respect to the second alteration, the Examiner is asserting that given that one would make the first alteration, the apparatus of Liou would be further modified to include both of the light sources discussed above with one of the light sources being the supplemental light source that is turned on when there is too little light, as opposed to changing the intensity of the light source in each of the embodiments taught in Liou as suggested by Lauffenburger. The Examiner does not point to any teaching that would cause someone to choose this alternative as opposed to altering the intensity of the one light source.

In fact, such a two light source embodiment would, at best, be less effective than either of the embodiments discussed in Liou, and would probably be inoperative. For an embodiment to function with transmissive lighting, i.e., the light source on the opposite side of the grid pattern from the photodetectors, the grid pattern must consist of opaque lines separated by clear spaces that transmit the light. The clear spacings appear bright to an

apparatus viewing the illuminated pattern. If a second light source is now used to illuminate the pattern from above, the only light that reaches the photodetectors from this second source is the light that is reflected from the top surface of the opaque lines, since the light that strikes the clear areas is transmitted toward the other light source. Hence, the opaque lines appear bright, not the transparent spaces when viewed with light from the second light source. Hence, the second light source reduces the contrast between the lines and the spacings between the lines that was created by the first light source.

With respect to the third alteration, the Examiner has not pointed to any teaching in the art, as opposed to the present application, that a supplemental light source would be advantageous is curing a lack of light from the primary light source. The cited reference teaches using a light source that has an adjustable output intensity and adjusting that output intensity in response to insufficient light.

Accordingly, Applicant submits that the Examiner has not pointed to any teaching in the art that would cause someone to make both of these modifications, and if anything, the modifications would not provide any advantages in the system taught in Liou. Accordingly, there are additional grounds for allowing Claims 4 and 21.

3. Rejection of Claims 5, 8, 13 and 16 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Mumford.

Rejections of Claims 5 and 13.

Claim 5 depends from Claim 1, and Claim 13 depends from Claim 11. Applicant repeats the arguments made above with respect to the missing teachings in Liou. The Examiner has not pointed to any teachings in Mumford that provide the missing teachings in Liou. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 5 and 13.

Rejections of Claim 8 and 16.

Claim 8 depends from Claim 1, and Claim 16 depends from Claim 11. Applicant repeats the arguments made above with respect to the missing teachings in Liou. The Examiner has not pointed to any teachings in Mumford that provide the missing teachings in Liou. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 8 and 16.

In addition, Claims 8 and 16 include the additional limitation that the light source is a liquid crystal display and that the detectable texture is the pixels of this display. The Examiner admits that Liou does not teach this additional limitation and looks to Mumford as providing the missing teaching.

Mumford teaches a light pen that operates on a liquid crystal display. The position of the pen is determined by applying a particular color pattern on the display and then detecting the color of the pixel over which the pen is positioned. The Examiner looks to Mumford as teaching that the illuminated surface that is detected in Liou could be a liquid crystal display. The Examiner maintains that one would alter the illuminated surface in Liou to include a liquid crystal display to provide a light pen system in which the writing/detection tablet is not physically separated from the display screen.

First, it should be noted that there is a fundamental problem in using the apparatus of Liou to determine the position of the reading head on a surface that displays another scene whether that surface is a liquid crystal display or a cathode ray tube, as discussed below. The system of Liou assumes that the image being processed by the photodiodes and related optics is a specific two-dimensional grid pattern consisting of lines and spaces in which the spaces between the lines are the same width as the lines. If another pattern is also present on the display, the photodiodes and optics must process a pattern that is the sum of the two patterns. This compound pattern no longer meets the criterion required for the navigation pattern. Hence, the only possible combination that might produce an operable device is one in which the grid pattern is generated on the display and no other pattern is generated with it. This is equivalent to replacing the printed pattern taught in Liou with a display screen that generates the same pattern. The Examiner has not pointed to any advantage of such a device over that taught in Liou.

Second, replacing the illuminated grid pattern in Liou with a liquid crystal display does not provide any advantage in the device taught in Liou. If anything, such a substitution would increase the cost and decrease the accuracy of detection. The encoder of Liou depends on a specific pattern on the illuminated surface. The accuracy of position measurement depends on the accuracy of the pattern. The pattern in Liou is limited only by the accuracy of the patterns that can be generated using photolithography. The accuracy of a pattern that can be generated on a liquid crystal display is limited by the size of the pixels on that display. The available pixel sizes are much larger than then the smallest feature that can be printed using photolithography.

In addition, even if one could provide a liquid crystal display of the same accuracy as the printed patterns used in Liou, nothing would be accomplished other than an increase in the cost of the encoder system taught in Liou. One would merely be replacing a line pattern printed on a reflective or transmissive boundary with a liquid crystal display in which the pattern displayed is constant over time. The cost of the liquid crystal display is orders of magnitude higher than the printed pattern. Accordingly, there is no reasonable expectation of success in making the substitution suggested by the Examiner. Hence, there are additional grounds for allowing Claims 8 and 16.

4. Rejection of Claims 6 and 14 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Minn.

Claim 6 depends from Claim 1, and Claim 14 depends from Claim 11. Applicant repeats the arguments made above with respect to the missing teachings in Liou. The Examiner has not pointed to any teachings in Minn that provide the missing teachings in Liou. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 6 and 14.

In addition, Claims 6 and 14 include the additional limitation that the light source is a cathode ray tube and that the detectable texture is the shadow mask on the cathode ray tube. The Examiner admits that Liou does not teach this additional limitation and looks to Minn as providing the missing teaching. The Examiner maintains that it would have been obvious to one of ordinary skill in the art to incorporate the teachings of Minn in the teachings of Liou to

have a device that reads the shadow mask of a cathode ray tube so that it can be used directly on the display surface of a cathode ray tube.

First, as noted above, the combination of the apparatus of Liou with a display screen is only operable if the display screen is limited to displaying the grid pattern taught in Liou. Any additional information would cause the apparatus of Liou to be inoperative with respect to providing its navigation function.

Second, Minn teaches a light pen that operates on the surface of a cathode ray tube having a shadow mask; however, the light pen of Minn does not detect the shadow mask. The light pen of Minn determines the position of the light pen on the tube surface by reading out the x and y coordinates of the spot on the cathode ray tube when the light pen detects light during the normal raster scanning of the tube surface. This is a conventional light pen arrangement. Minn is directed to providing a better phosphor composition for the surface of the tube. There is no teaching in Minn of reading the shadow mask. In fact, the scheme taught therein operates on cathode ray tubes that lack any form of shadow mask.

Third, the apparatus of Liou depends on the detected pattern being constantly illuminated over the entire portion of the pattern that is viewed by the photodiodes. A cathode ray tube only illuminates one point at a time. Hence, the resultant apparatus would not function without additional modifications.

Fourth, the Examiner has not pointed to any teaching that the shadow mask of a conventional CRT provides the grid pattern required by the apparatus of Liou. A shadow mask on a CRT typically consists of circular holes in an opaque layer. This is not the grid pattern required by Liou. Hence, the shadow mask does not inherently have a property that would allow the apparatus of Liou to function using that mask as the grid pattern.

Hence, there are additional grounds for allowing Claims 6 and 14.

5. Rejection of Claims 7 and 15 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Ditzik.

Claim 7 depends from Claim 1, and Claim 15 depends from Claim 11. Applicant repeats the arguments made above with respect to the missing teachings in Liou. The Examiner has not pointed to any teachings in Ditzik that provide the missing teachings in Liou. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 7 and 15.

In addition, Claims 7 and 15 include the additional limitation that the light source is a liquid crystal display and that the detectable texture is the diffuser plate of the liquid crystal display. The Examiner admits that Liou does not teach this additional limitation and looks to Ditzik as providing the missing teaching. The Examiner maintains that it would have been obvious to one of ordinary skill to incorporate the teachings of Ditzik in the teachings of Liou to have a liquid crystal display with a diffuser plate as the illuminated surface in order to utilize a commonly used display device and to have a diffuser to evenly distribute the backlight over the screen area.

First, as noted above, the combination of the apparatus of Liou with a display screen is only operable if the display screen is limited to displaying the grid pattern taught in Liou. Any additional information would cause the apparatus of Liou to be inoperative with respect to providing its navigation function.

Second, Applicant must disagree with the Examiner's reading of Ditzik. There is no teaching in Ditzik that the optional diffuser plate taught therein has a detectable texture, no less that such a texture is visible from the front side of the display in a manner that would allow it to function as the pattern required in the apparatus of Liou. For example, a plate consisting of scattering particles having dimensions of the order of the wavelength of the light from the light source will provide the desired diffusion property without presenting a texture that can be imaged. In fact, the goal of a diffuser plate is blur any detactable pattern present in the light source that is illuminating the liquid crystal display. Furthermore, Liou requires a particular detectable pattern, i.e., a grid pattern of lines in which the width of the lines is equal to space between the lines. If such a pattern was executed at a scale that could be detected in the manner required by the apparatus of Ditzik, it would not provide the diffusion function.

Third, the diffusion plate taught in Ditzik is behind the liquid crystal panel. It is only visible through those pixels that are open at any given time. The pixels of the panel are opened and closed at times that depend on the image being displayed. Hence, there is no stable pattern that is visible through the liquid crystal display. As noted above, the apparatus of Liou requires that the pattern in the region being illuminated be illuminated in a continuous manner so that the photodetectors can generate the required signals and compare the signals to one another. Hence, even if one were to put the appropriate grid pattern on the diffuser plate in question, the resultant apparatus would not operate in the intended manner. Hence, there is no reasonable expectation of success in making the alterations suggested by the Examiner. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 7 and 15.

6. Rejection of Claims 9, 10, 17, and 18 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Burns (US 5,442,147).

Claims 9 and 10 are dependent from Claim 1, and Claims 17 and 18 are dependent from Claim 11. These claims require that the detectable texture be on a semi-transparent layer that is overlaid over the illuminated surface. Applicant repeats the arguments made above with respect to the missing teachings in Liou with respect to Claims 1 and 11. The Examiner has not pointed to any teachings in Burns that provide the missing teachings. Hence, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 9, 10, 17 and 18.

Claims 10 and 18 further require that the semi-transparent layer provide unique positioning information that provides absolute position information for the apparatus relative to the illumination surface. The Examiner looks to Burns for the missing teachings. Applicant submits that the issue is not whether Burns teaches a semi-transparent layer with a unique pattern for absolute navigation, but whether such a pattern could be used in the apparatus of Liou and still have a functioning device. The apparatus taught by Liou requires a repetitive pattern, namely, a rectilinear grid having a specific relationship between the width of the dark and light regions, in order to function. The pattern in the layer taught by Burns would not comply with this requirement, and so the combination would not be operative.

Furthermore, to provide absolute position information, the pattern must change as one moves from position to position on the surface. However, the apparatus of Liou is incapable

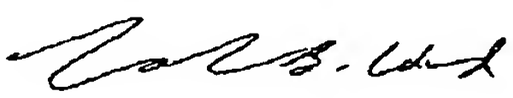
of detecting such changes. The apparatus of Liou only outputs 4 logic signals, two that provide an indication of the position in each dimension and the direction of motion since the last change in the state of the signals. Hence, the encoder of Liou is constrained to providing relative changes in position, and could not provide an absolute position indication without further alterations. Accordingly, there are additional grounds for allowing Claims 10 and 17.

VIII. CONCLUSION

Appellant respectfully submits that for the reasons of fact and law argued herein, the decision of the Examiner in finally rejecting Claims 1, 2, 4-11, 13-18, 20-21 should be reversed.

I hereby certify that this paper (along with any others attached hereto) is being sent via facsimile to fax number: 571-273-8300

Respectfully Submitted,



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APPENDIX

THE CLAIMS ON APPEAL:

1. An apparatus for optical navigation comprising:

a surface comprising an aperture, said surface configured to be moveable against an illuminated surface having a detectable texture;

an optical motion detection circuit integral to said apparatus and optically coupled to said detectable texture of said illuminated surface, said optical motion detection circuit comprising a single detector for acquiring images of said surface at a specified rate, said detector acquiring a single image at a time, and comprising an image processor producing motion signals indicative of motion of said surface relative to said detectable texture of said illuminated surface, wherein said motion signals are produced by comparing two said images and comprise a change in location in a first axis and a change in location in a second axis, wherein said optical motion detection circuit is operable to detect said detectable texture without requiring an integral illumination source.

2. The apparatus as recited in Claim 1 further comprising an optical element integral to said apparatus, said optical element proximate said aperture and receiving light from said detectable texture of said illuminated surface, said optical element operable to optically couple said optical motion detection circuit integral to said detectable texture of said illuminated surface.

4. The apparatus as recited in Claim 1 further comprising a supplemental light source operable to provide additional illumination onto said illuminated surface in response to said optical motion detection circuit detecting insufficient illumination of said illumination surface.

5. The apparatus as recited in Claim 1 further comprising an internal power source for providing power to said apparatus.

6. The apparatus as recited in Claim 1 wherein said illuminated surface is a cathode ray tube and wherein said detectable texture is a shadow mask of said cathode ray tube.

7. The apparatus as recited in Claim 1 wherein said illuminated surface is a liquid crystal display and wherein said detectable texture is a diffuser plate of said liquid crystal display.

8. The apparatus as recited in Claim 1 wherein said illuminated surface is a liquid crystal display and wherein said detectable texture comprises pixels of said liquid crystal display.

9. The apparatus as recited in Claim 1 wherein said illuminated surface is overlaid with a semi-transparent layer comprising said detectable texture.

10. The apparatus as recited in Claim 9 wherein said semi-transparent layer comprises unique positioning information providing absolute position information of said apparatus relative to said illuminated surface.

11. An electronic device for optical navigation on a display screen, said electronic device comprising:

a surface comprising an aperture, said surface configured to be moveable against a display screen having a detectable texture when illuminated;

an optical element integral to said electronic device, said optical element proximate said aperture and receiving light from said detectable texture when illuminated; and

an optical motion detection circuit integral to said electronic device and optically coupled by said optical element to said detectable texture of said display screen said optical motion detection circuit comprising an single detector for acquiring images of said surface at a specified rate, said detector acquiring a single image at a time, and comprising an image processor producing motion signals indicative of motion of said surface relative to said detectable texture of said display screen when illuminated, wherein said motion signals are

produced by comparing two said images and comprise a change in location in a first axis and a change in location in a second axis, wherein said optical motion detection circuit is operable to detect said detectable texture without requiring an integral illumination source.

13. The electronic device for optical navigation on a display screen as recited in Claim 11 further comprising an integral power source for providing power to said electronic device.

14. The electronic device for optical navigation on a display screen as recited in Claim 11 wherein said detectable texture is a shadow mask of a cathode ray tube.

15. The electronic device for optical navigation on a display screen as recited in Claim 11 wherein said detectable texture is a diffuser plate of a liquid crystal display.

16. The electronic device for optical navigation on a display screen as recited in Claim 11 wherein said detectable texture are pixels of a liquid crystal display.

17. The electronic device for optical navigation on a display screen as recited in Claim 11 wherein said display screen is overlaid with a semi-transparent layer comprising said detectable texture.

18. The electronic device for optical navigation on a display screen as recited in Claim 17 wherein said semi-transparent layer comprises unique positioning information providing absolute position information of said electronic device relative to said display screen.

20. A method for optical navigation on an illuminated surface using an electronic device, said method comprising:

acquiring a first frame from said illuminated surface at a single detector of said electronic device, such that said electronic device does not require an internal illumination source to provide illumination to said illuminated surface;

acquiring a second frame at said single detector from said illuminated surface:

determining a change in position in a first axis and in a second axis of said electronic device relative to said illuminated surface based on said first frame and said second frame,

wherein said determining a change in position comprises:

computing correlation values for said first frame and said second frame after said second frame has been shifted along one of said axes to determine an indication of movement of said electronic device from said first frame to said second frame;

predicting a shift in position from said first frame based on said correlation values: and

outputting a motion signal indicating said shift in position.

21. The method as recited in Claim 20 further comprising:

determining whether illumination provide by said illuminated surface sufficient for said acquiring said first frame; and

provided said illumination provided by said illuminated surface is not sufficient for said acquiring said first frame, providing additional illumination onto said illuminated surface.

22. A method for optical navigation on an illuminated surface using an electronic device, said method comprising:

acquiring a first frame from said illuminated surface at a single detector of said electronic device, such that said electronic device does not require an internal illumination source to provide illumination to said illuminated surface;

acquiring a second frame at said single detector from said illuminated surface;

determining a change in position in a first axis and in a second axis of said electronic device relative to said illuminated surface based on said first frame and said second frame;

wherein said determining a change in position comprises;

computing correlation values for said first frame and said second frame, said correlation values indicating movement of said electronic device from said first frame to said second frame;

predicting a shift in position from said first frame based on said correlation values; and

outputting a motion signal indicating said shift in position, said method further comprising:

determining whether illumination provided by said illuminated surface interferes with said acquiring said first frame; and

provided said illumination provided by said illuminated surface interferes with said acquiring said first frame, providing interference reducing illumination onto said illuminated surface; and

filtering said illumination such that said electronic device can acquire said first frame using said interference reducing illumination.

Evidence Appendix

none

Related Proceedings Appendix

none

PATENT APPLICATION
Attorney Docket: 10030187-1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF APPEALS

Applicant:	Xie, et al
Serial No.:	10/655,946
Filed:	9/4/2003
For:	An Apparatus for Optical Navigation
Group Art Unit:	2629
Examiner:	Sherman, Stephen

BRIEF FOR APPELLANT

Commissioner For Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an appeal from the decision of the Primary Examiner dated 12/5/2006, finally rejecting Claims 1, 2, 4-11, 13-18, 20-21 in the above-identified patent application.

I. REAL PARTY IN INTEREST

The real party in interest is Avago Technologies, LTD. having an address as indicated below.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to appellant, the appellant's legal representative, or assignee which will directly affect, or be directly affected by, or have a bearing on, the Board's decision in this pending appeal.

III. STATUS OF THE CLAIMS

Claims 1, 2, 4-11, 13-18, 20-21 are currently pending in the above-identified patent application. In the Office Action dated 12/5/2006, the Examiner rejected Claims 1, 2, 4-11, 13-18, 20-21 and indicated that the Action was final.

IV. STATUS OF AMENDMENTS

An amendment under 37 C.F.R. 1.116 was filed on 1/15/2007. In an advisory action dated 2/2/2007, the Examiner indicated that the amendment would be entered on filing an appeal. The attached claims reflect this amendment.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention is directed to an optical navigation apparatus. With respect to Claims 1 and 2, refer to Figure 2A and the discussion thereof that begins on page 9 at line 3 of the present application. The apparatus, having a surface 180 with an aperture 185, can be moved over an illuminated surface 206 that has a detectable texture. An integral optical motion detection circuit 210, including a single detector that acquires images at a specified rate, is optically coupled to that texture. The circuit includes an image processor that compares two images from the imaging detector to calculate motion signals representing position changes of the navigation apparatus relative to the illuminated surface, along two axes. No integral illumination source is required. Claim 2 specifies an additional optical element integral to the apparatus that achieves the optical coupling required, such as the lens 208 shown in Figure 2A. Claim 4 relates to the inclusion of a supplemental light source for the purpose of supplementing the illumination of the textured surface when the optical detection circuit determines that the illumination is insufficient. Such a supplemental light source is shown as element 222 in Figure 2B. Claim 5 relates to the inclusion of an internal power source, such as element 150, shown in Figure 1B.

Claims 6-8 relate to the use of the optical navigation apparatus over two different types of illuminated surfaces with correspondingly different detectable textures. Claim 6 concerns the use of the shadow mask of a CRT as the texture; such a mask is shown at 404 in Figures 4A and 4B. Claim 7 is directed to the use of the diffuser plate 442 of a liquid crystal display as the texture; diffuser plate 442 is shown in Figure 4C. Claim 8 concerns the use of the pixel matrix of a liquid crystal display as the texture. A pixel matrix of this type is shown as element 434 in Figure 4C; Claims 9-10 relate to details of implementations that use an

overlaid semi-transparent layer to provide the detectable texture. An example of such a layer is shown as element 442 in Figure 4C. Claim 10 is directed to embodiments in which the overlaid layer provides absolute position information that can be used to provide the location of the detector on the surface as opposed to the change in location from the previous location.

Claims 11 and 13-16 relate to implementations of the basic apparatus described above as electronic devices that are designed for navigation over a display screen. Figure 2B and Figure 3 show the core features detailed in Claim 11, including a surface 180 with an aperture 185, moveable over the screen of a display, here represented by element 206 which has a detectable texture when illuminated, an integral optical element such as 206 close to the aperture, receiving light from the textured surface, and an optical motion detection circuit 210. The circuit has a single detector 304, acquires images at a specified rate, a single image at a time, and includes an image processor 306 that produces motion signals indicating the motion of the apparatus relative to the detectable texture. These signals indicate the change in location along two axes, and are produced by comparing two images. No integral illumination source is required for the image acquisition. Claim 13 specifies the inclusion of an internal power source, such as that shown as element 150 in Figure 1B. Claims 14-17 relate to different detectable textures. Claim 14 concerns the use of a shadow mask of a CRT, shown as element 404 in Figure 4B. Claim 15 concerns the use of a diffuser plate on a liquid crystal display, shown as element 442 in Figure 4C, while Claim 16 concerns the use of the pixel matrix of a liquid crystal display, shown as element 434 in Figure 4C. Claim 18 specifies the feature of an overlaid layer, such as element 442 in Figure 4C, providing absolute position information.

With respect to Claims 20-21, refer to Figures 5A and 5B and the discussion thereof that begins on Page 15 at line 10. Claim 20 describes a method for optical navigation of an electronic device over an illuminated surface. The method, outlined in the flowchart of Figure 5A, involves acquiring two frames, using these to determine the relative change in position, along two axes, between the device and the illuminated surface, by computing correlation values for the two frames. The position shift is predicted and the corresponding motion signal is output. Claim 21 concerns the addition of supplemental illumination if it is determined that the surface illumination is otherwise insufficient for frame acquisition. The process outline is given in the flowchart of Figure 5B.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Rejection of Claims 1, 2, 11 and 20 under 35 U.S.C. 102(b) as being anticipated by Liou (US 5,086,197).

Rejection of Claims 4 and 21 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Lauffenburger *et al* (hereafter "Lauffenburger") (US 6,963,059).

Rejection of Claims 5, 8, 13 and 16 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Mumford (US 6,377,249).

Rejection of Claims 6 and 14 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Minn (US 4,565,947).

Rejection of Claims 7 and 15 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Ditzik (US 5,771,039).

Rejection of Claims 9, 10, 17, and 18 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Burns (US 5,442,147).

VII. ARGUMENT

A. Examiner's Burden under 35 U.S.C. 102

The Examiner has the burden of showing by reference to the cited art each claim limitation in the reference. Anticipation under 35 U.S.C. 102 requires that each element of the claim in issue be found either expressly or inherently in a single prior art reference. In re King, 231 USPQ 136, 138 (Fed. Cir. 1986); Kalman v. Kimberly-Clark Corp., 218 USPQ 781, 789 (Fed. Cir. 1983). The mere fact that a certain thing may result from a given set of circumstances is not sufficient to sustain a rejection for anticipation. *Ex parte Skinner*, 2 USPQ2d 1788, 1789 (BdPatApp&Int 1986). "When the PTO asserts that there is an explicit or implicit teaching or suggestion in the prior art, it must indicate where such a teaching or suggestion appears in the reference" (*In re* Rijckaert, 28 USPQ2d, 1955, 1957).

Under the doctrine of inherency, if an element is not expressly disclosed in a prior art reference, the reference will still be deemed to anticipate a subsequent claim if the missing element "is necessarily present in the thing described in the reference" Cont'l Can Co. v. Monsanto Co., 948 F.2d 1264, 1268, 20 USPQ2d 1746, 1749(Fed. Cir. 1991). "Inherent anticipation requires that the missing descriptive material is 'necessarily present,' not merely probably or possibly present, in the prior art." Trintec Indus., Inc. v. Top-U.S.A. Corp., 295 F.3d 1292, 1295, 63 USPQ2d 1597, 1599(Fed. Cir. 2002) (quoting In re Robertson, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999)).

B. Examiner's Burden under 35 U.S.C. 103

To sustain a rejection under 35 U.S.C. 103, the Examiner must show that the combined references teach each of the elements of the claim or that there is some motivation in the art for altering one of the teachings to arrive at the combined set of teachings. "The mere fact that a reference could be modified to produce the patented invention would not make the modification obvious unless it is suggested by the prior art." (*Libbey-Owens-Ford v. BOC Group*, 4 USPQ 2d 1097, 1103). In addition, the Examiner must show that there is some motivation in the art that would cause someone of ordinary skill to combine the references, and that in making the combination, there was a reasonable expectation of success. Where the claimed subject matter has been rejected as obvious in view of a combination of prior art references, a proper analysis under section 103 requires, *inter alia*, consideration of two factors: (1) whether the prior art would have suggested to those of ordinary skill in the art that they should make the claimed composition or device, or carry out the claimed process; and (2) whether the prior art would also have revealed that in so making or carrying out, those of ordinary skill would have a reasonable expectation of success. Both the suggestion and the reasonable expectation of success must be founded in the prior art, not in the applicant's disclosure. *In re Vaeck*, 20 USPQ2d 1438, 1442(CAFC 1991).

C. Essence of Examiner's Argument as to the Teachings of Liou

The Examiner's rejections are all based on Liou, either alone or in combination with one or more additional references. These rejections are based on the Examiner's assertion that Liou teaches 5 limitations of the claims. If the Examiner is incorrect in the Examiner's reading of Liou, the anticipation rejections cannot be sustained. Furthermore, the

obviousness rejections are also flawed in that these rejections assume that the elements in question are present in Liou, as the secondary references do not supply the missing teachings. To avoid repeating the details of the arguments with respect to the Examiner's reading of Liou, Applicant will discuss these limitations in detail here. The 5 limitations in question are as follows.

1. The Examiner maintains that Liou teaches a device in which the displacement of the apparatus over the illuminated surface is determined from two images of the surface, taken by a single detector consisting of 4 photodetectors. The Examiner maintains that the outputs of these 4 photodetectors form an image and points to Applicant statements that an imaging array can be constructed from a plurality of individual imaging elements.

First, the fact that an imaging array can be formed from a collection of photodetectors does not imply that every collection of photodetectors that receives light from a scene is an imaging array that forms an image of a scene. Since the term image is not specifically defined in the present application, one must look to what someone of ordinary skill would interpret that term to mean. In this regard, it should be noted that the various definitions of an "image" all require that the image is a representation of a thing that closely resembles that thing (see Concise Oxford Dictionary or American Heritage Dictionary). The "thing" being imaged in Liou is a two-dimensional grid of lines crossing at right angles. The lines in each dimension have a spacing and width such that the spaces between the lines are equal to the widths of the lines. The 4 signals generated by the apparatus of Liou at any given time do not resemble a grid of lines crossing at right angles and having a spacing and width such that the spaces between the lines are equal to the widths of the lines. In fact, 4 pixels could not represent such a scene.

Even if one were to interpret the 4 photodiode signals of Liou as being some form of "imaging array", the arrangement taught in Liou corresponds to two detectors that form two one-dimensional "images", and hence, any two "images" taken by either detector taught in Liou can only provide information along one axis. Liou treats the outputs of each pair of photodetectors separately. One pair provides an output equivalent to a conventional one-dimensional encoder operating in one direction, and the other pair provides an output equivalent to a conventional one-dimensional encoder operating in the orthogonal direction

(column 3, lines 65-66). Hence, the signals are not pixels in a two-dimensional image, but rather the results of a mathematical operation performed on an image of the surface to provide signals that are function in the same manner as a pair of conventional encoders.

In fact, the Examiner points to the comparison of the outputs from one pair of detectors taken at different times as corresponding to computing a correlation value between two images. Hence, the Examiner admits that each pair of detectors is a separate "imaging array" even in the interpretation put forth by the Examiner.

2. The Examiner maintains that Liou teaches a device having an integral optical motion detection circuit. Applicant submits that the circuit taught in Liou generates a signal independent of the motion of the imaging means relative to the grid pattern. The circuit of Liou requires an external circuit to convert that signal to one that detects motion, and hence, the motion detection circuit is not integral to the apparatus of Liou.

The Examiner attempts to overcome this problem by stating that the word "integral" does not exclude an "external" circuit outside the device. Applicant respectfully disagrees. The first definition of the word "integral" in the American Heritage Dictionary is "Essential or necessary for completeness; constituent"; the second is "Possessing everything essential; entire". Liou does not teach a circuit with any of these characteristics.

The issue is not whether Liou teaches a system that excludes an external circuit but whether Liou teaches the integral limitation of the claim either explicitly or inherently. The Examiner has not pointed to any explicit teaching in Liou of an integral motion detector. Hence, the Examiner must be arguing that the teaching is inherent in the reference. In this regard, it is sufficient to note that the device of Liou or a device using the device of Liou does not have to detect motion. Liou teaches a form of encoder head that operates on a particular code surface. Encoders provide an indication of the position of the head relative to the surface without generating a signal indicative of the motion of the head over the surface. While one could generate a motion signal from the outputs provided by the apparatus of Liou, such a signal is not required, and hence, the teaching is not necessarily present as required by the doctrine of inherency.

3. The Examiner maintains that Liou teaches a device that acquires images at a specified rate. The Examiner has not pointed to any explicit teaching in Liou of a circuit that acquires images at a specified rate. Instead, the Examiner argues that the teaching is inherent in the reference. The Examiner states that Liou satisfies the limitation since Liou must operate at some operating frequency. That is, the device taught in Liou forms "images" at regular intervals.

The Examiner's argument rests on the premise that every device samples at a finite fixed frequency to provide its output. This is clearly not the case, since numerous examples of devices that provide a signal that changes continuously in time are known. At the quantum limit, one could argue that the signal changes in discrete steps as individual electrons leave the apparatus. But even in this case, the steps would not be characterized by a regular time interval.

Furthermore, Liou teaches a device that outputs 4 signals on a continuous basis. There is no teaching that the signals are output at a predetermined frequency. Furthermore, since the signals are intended to duplicate the output of two conventional encoder heads. Such encoders do not sample the signals. While a device receiving the signals might sample the signals at a fixed frequency, there is no such teaching in Liou and such sampling is not required. Furthermore, an incorrect sampling rate could lead to a position error if regular sampling strategy were utilized in the apparatus of Liou. For example, consider the case in which the encoding head moved by a distance equal to the period in the grid pattern, i.e., the distance between the centers of two adjacent lines. In this case, there is no change in the state of the outputs from the photodetectors. Hence, the change in position would not be detected.

4. The Examiner maintains that Liou teaches a method in which two image frames are shifted along one axis and correlation values are computed to determine the actual position shift of a device over an illuminated surface. The Examiner's argument depends on the Examiner's definition of correlation value as being any value that is a measure of the relationship between two variables, and since Liou teaches comparing the current values of the output of the detectors to previous values, the Examiner maintains that Liou is computing a correlation value.

The relevant claim limitation requires that two frames be formed, one of the frames shifted with respect to the other frame, and then a correlation value be computed. The Examiner has not pointed to any shifting of frames. At best, one could argue that Liou teaches comparing two corresponding pixels in two frames taken at different times, but without shifting.

5. The Examiner maintains that the apparatus of Liou does not require an integral illumination source, since Liou teaches one embodiment in which the light source is outside of one of the components of the apparatus. Applicant submits that Figure 1 shows, and the text specifically describes (column 2 lines 44-45), the apparatus taught by Liou as **including** a light source, namely element 10 or element 10'. Applicant submits that the fact that the source 10' is positioned outside one component of the apparatus does not mean that it is not an integral part of the apparatus.

D. Rejection of Claims 1, 2, 4-11, 13-18, 20-21

1. Rejection of Claims 1-2, 11 and 20 under 35 U.S.C. 102(b) as being anticipated by Liou.

First, with regard to the limitation in Claim 1 requiring an integral optical motion detection circuit, the Examiner states that the "claim never states this limitation". Applicant must dispute this statement, as Claim 1 clearly specifies "an optical motion detection circuit integral to said apparatus".

Second, Claims 1, 2 and 11 require limitations 1, 2, 3, and 5, discussed above. Applicant maintains that Liou does not teach these four limitations, and hence, Liou does not anticipate these Claims.

Finally, Claim 20 requires limitations 1, 4, and 5, discussed above. Applicant maintains that Liou does not teach these three limitations, and hence, Liou does not anticipate Claim 20.

2. Rejection of Claims 4 and 21 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Lauffenburger.

Claim 4 depends from Claim 1, and Claim 21 depends from Claim 20. In addition to the limitations of the base claims, these claims require that the apparatus include a supplemental light source that provides additional illumination of the surface in response to the optical motion detection circuit detecting insufficient illumination of the surface.

In the Examiner's first rejection of these claims on this grounds, the Examiner admitted that Liou does not teach such a supplemental light source, and the Examiner looked to Lauffenburger as providing the missing teachings. When Applicant pointed out that Lauffenburger taught changing the intensity of a single light source rather than teaching the inclusion of a supplemental light source, the Examiner switched his argument to state that Lauffenburger was only cited to show that changing the intensity of the light source was known to have advantages. The Examiner then went on to assert that one of the two light sources taught in Liou could be the supplemental light source that was turned on in response to a determination that there was insufficient illumination. As best Applicant can understand the Examiner's current grounds in this rejection, Applicant assumes that the Examiner is arguing that one would be motivated to change the light sources in the apparatus of Liou to arrive at an apparatus that satisfies the limitations of Claims 4 and 21. Three separate changes would be required. First, a circuit that determines that there is insufficient illumination would need to be added to the apparatus of Liou. Second, the apparatus of Liou would need to be modified to include both of the light sources rather than one or the other as now taught in Liou. Third, the apparatus would be modified to run on only one of the two light sources unless the new circuit determined that the light levels were too low. The circuit would then cause the second light source to be activated.

First, Applicant repeats the arguments made above with respect to Claims 1 and 20 from which Claims 4 and 21 depend, respectively. Applicant submits that the teachings discussed above as missing from Liou are not provided by Lauffenburger. Hence, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 4 and 21, independent of the additional limitations of Claims 4 and 21.

Second, Claims 4 and 21 require "supplemental" and "additional" illumination respectively, in the cases where the optical motion detection circuit detects that there is insufficient illumination of the surface. The Examiner maintains that since Liou teaches two light sources, one of the light sources could be regarded as a supplemental light source for the other. Initially, it should be noted that Liou does not teach an embodiment in which both light sources are present simultaneously under any circumstance. Liou teaches two separate embodiments, one a light source on the same side of the pattern as the detectors, and one utilizing the light source on the other side of the pattern from the detectors.

With respect to the first alteration, it should be noted that the target pattern illuminated in the Liou apparatus is known at the time the apparatus is designed and remains fixed throughout the lifetime of the apparatus. Hence, the designer merely provides a light source of required brightness that is incorporated at the time the apparatus is manufactured. Hence, absent some teaching that this light source would change intensity over time by an amount that would cause the accuracy of the encoding system taught therein to significantly decrease, there is no motivation for including an additional circuit that measures the amount of light reaching the photodetectors and determines whether or not the detected light is sufficient. The Examiner has not pointed to any teaching in the references that this light source would change in this manner.

With respect to the second alteration, the Examiner is asserting that given that one would make the first alteration, the apparatus of Liou would be further modified to include both of the light sources discussed above with one of the light sources being the supplemental light source that is turned on when there is too little light, as opposed to changing the intensity of the light source in each of the embodiments taught in Liou as suggested by Lauffenburger. The Examiner does not point to any teaching that would cause someone to choose this alternative as opposed to altering the intensity of the one light source.

In fact, such a two light source embodiment would, at best, be less effective than either of the embodiments discussed in Liou, and would probably be inoperative. For an embodiment to function with transmissive lighting, i.e., the light source on the opposite side of the grid pattern from the photodetectors, the grid pattern must consist of opaque lines separated by clear spaces that transmit the light. The clear spacings appear bright to an

apparatus viewing the illuminated pattern. If a second light source is now used to illuminate the pattern from above, the only light that reaches the photodetectors from this second source is the light that is reflected from the top surface of the opaque lines, since the light that strikes the clear areas is transmitted toward the other light source. Hence, the opaque lines appear bright, not the transparent spaces when viewed with light from the second light source. Hence, the second light source reduces the contrast between the lines and the spacings between the lines that was created by the first light source.

With respect to the third alteration, the Examiner has not pointed to any teaching in the art, as opposed to the present application, that a supplemental light source would be advantageous is curing a lack of light from the primary light source. The cited reference teaches using a light source that has an adjustable output intensity and adjusting that output intensity in response to insufficient light.

Accordingly, Applicant submits that the Examiner has not pointed to any teaching in the art that would cause someone to make both of these modifications, and if anything, the modifications would not provide any advantages in the system taught in Liou. Accordingly, there are additional grounds for allowing Claims 4 and 21.

3. Rejection of Claims 5, 8, 13 and 16 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Mumford.

Rejections of Claims 5 and 13.

Claim 5 depends from Claim 1; and Claim 13 depends from Claim 11. Applicant repeats the arguments made above with respect to the missing teachings in Liou. The Examiner has not pointed to any teachings in Mumford that provide the missing teachings in Liou. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 5 and 13.

Rejections of Claim 8 and 16.

Claim 8 depends from Claim 1, and Claim 16 depends from Claim 11. Applicant repeats the arguments made above with respect to the missing teachings in Liou. The Examiner has not pointed to any teachings in Mumford that provide the missing teachings in Liou. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 8 and 16.

In addition, Claims 8 and 16 include the additional limitation that the light source is a liquid crystal display and that the detectable texture is the pixels of this display. The Examiner admits that Liou does not teach this additional limitation and looks to Mumford as providing the missing teaching.

Mumford teaches a light pen that operates on a liquid crystal display. The position of the pen is determined by applying a particular color pattern on the display and then detecting the color of the pixel over which the pen is positioned. The Examiner looks to Mumford as teaching that the illuminated surface that is detected in Liou could be a liquid crystal display. The Examiner maintains that one would alter the illuminated surface in Liou to include a liquid crystal display to provide a light pen system in which the writing/detection tablet is not physically separated from the display screen.

First, it should be noted that there is a fundamental problem in using the apparatus of Liou to determine the position of the reading head on a surface that displays another scene whether that surface is a liquid crystal display or a cathode ray tube, as discussed below. The system of Liou assumes that the image being processed by the photodiodes and related optics is a specific two-dimensional grid pattern consisting of lines and spaces in which the spaces between the lines are the same width as the lines. If another pattern is also present on the display, the photodiodes and optics must process a pattern that is the sum of the two patterns. This compound pattern no longer meets the criterion required for the navigation pattern. Hence, the only possible combination that might produce an operable device is one in which the grid pattern is generated on the display and no other pattern is generated with it. This is equivalent to replacing the printed pattern taught in Liou with a display screen that generates the same pattern. The Examiner has not pointed to any advantage of such a device over that taught in Liou.

Second, replacing the illuminated grid pattern in Liou with a liquid crystal display does not provide any advantage in the device taught in Liou. If anything, such a substitution would increase the cost and decrease the accuracy of detection. The encoder of Liou depends on a specific pattern on the illuminated surface. The accuracy of position measurement depends on the accuracy of the pattern. The pattern in Liou is limited only by the accuracy of the patterns that can be generated using photolithography. The accuracy of a pattern that can be generated on a liquid crystal display is limited by the size of the pixels on that display. The available pixel sizes are much larger than then the smallest feature that can be printed using photolithography.

In addition, even if one could provide a liquid crystal display of the same accuracy as the printed patterns used in Liou, nothing would be accomplished other than an increase in the cost of the encoder system taught in Liou. One would merely be replacing a line pattern printed on a reflective or transmissive boundary with a liquid crystal display in which the pattern displayed is constant over time. The cost of the liquid crystal display is orders of magnitude higher than the printed pattern. Accordingly, there is no reasonable expectation of success in making the substitution suggested by the Examiner. Hence, there are additional grounds for allowing Claims 8 and 16.

4. Rejection of Claims 6 and 14 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Minn.

Claim 6 depends from Claim 1, and Claim 14 depends from Claim 11. Applicant repeats the arguments made above with respect to the missing teachings in Liou. The Examiner has not pointed to any teachings in Minn that provide the missing teachings in Liou. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 6 and 14.

In addition, Claims 6 and 14 include the additional limitation that the light source is a cathode ray tube and that the detectable texture is the shadow mask on the cathode ray tube. The Examiner admits that Liou does not teach this additional limitation and looks to Minn as providing the missing teaching. The Examiner maintains that it would have been obvious to one of ordinary skill in the art to incorporate the teachings of Minn in the teachings of Liou to

have a device that reads the shadow mask of a cathode ray tube so that it can be used directly on the display surface of a cathode ray tube.

First, as noted above, the combination of the apparatus of Liou with a display screen is only operable if the display screen is limited to displaying the grid pattern taught in Liou. Any additional information would cause the apparatus of Liou to be inoperative with respect to providing its navigation function.

Second, Minn teaches a light pen that operates on the surface of a cathode ray tube having a shadow mask; however, the light pen of Minn does not detect the shadow mask. The light pen of Minn determines the position of the light pen on the tube surface by reading out the x and y coordinates of the spot on the cathode ray tube when the light pen detects light during the normal raster scanning of the tube surface. This is a conventional light pen arrangement. Minn is directed to providing a better phosphor composition for the surface of the tube. There is no teaching in Minn of reading the shadow mask. In fact, the scheme taught therein operates on cathode ray tubes that lack any form of shadow mask.

Third, the apparatus of Liou depends on the detected pattern being constantly illuminated over the entire portion of the pattern that is viewed by the photodiodes. A cathode ray tube only illuminates one point at a time. Hence, the resultant apparatus would not function without additional modifications.

Fourth, the Examiner has not pointed to any teaching that the shadow mask of a conventional CRT provides the grid pattern required by the apparatus of Liou. A shadow mask on a CRT typically consists of circular holes in an opaque layer. This is not the grid pattern required by Liou. Hence, the shadow mask does not inherently have a property that would allow the apparatus of Liou to function using that mask as the grid pattern.

Hence, there are additional grounds for allowing Claims 6 and 14.

5. Rejection of Claims 7 and 15 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Ditzik.

Claim 7 depends from Claim 1, and Claim 15 depends from Claim 11. Applicant repeats the arguments made above with respect to the missing teachings in Liou. The Examiner has not pointed to any teachings in Ditzik that provide the missing teachings in Liou. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 7 and 15.

In addition, Claims 7 and 15 include the additional limitation that the light source is a liquid crystal display and that the detectable texture is the diffuser plate of the liquid crystal display. The Examiner admits that Liou does not teach this additional limitation and looks to Ditzik as providing the missing teaching. The Examiner maintains that it would have been obvious to one of ordinary skill to incorporate the teachings of Ditzik in the teachings of Liou to have a liquid crystal display with a diffuser plate as the illuminated surface in order to utilize a commonly used display device and to have a diffuser to evenly distribute the backlight over the screen area.

First, as noted above, the combination of the apparatus of Liou with a display screen is only operable if the display screen is limited to displaying the grid pattern taught in Liou. Any additional information would cause the apparatus of Liou to be inoperative with respect to providing its navigation function.

Second, Applicant must disagree with the Examiner's reading of Ditzik. There is no teaching in Ditzik that the optional diffuser plate taught therein has a detectable texture, no less that such a texture is visible from the front side of the display in a manner that would allow it to function as the pattern required in the apparatus of Liou. For example, a plate consisting of scattering particles having dimensions of the order of the wavelength of the light from the light source will provide the desired diffusion property without presenting a texture that can be imaged. In fact, the goal of a diffuser plate is blur any detactable pattern present in the light source that is illuminating the liquid crystal display. Furthermore, Liou requires a particular detectable pattern, i.e., a grid pattern of lines in which the width of the lines is equal to space between the lines. If such a pattern was executed at a scale that could be detected in the manner required by the apparatus of Ditzik, it would not provide the diffusion function.

Third, the diffusion plate taught in Ditzik is behind the liquid crystal panel. It is only visible through those pixels that are open at any given time. The pixels of the panel are opened and closed at times that depend on the image being displayed. Hence, there is no stable pattern that is visible through the liquid crystal display. As noted above, the apparatus of Liou requires that the pattern in the region being illuminated be illuminated in a continuous manner so that the photodetectors can generate the required signals and compare the signals to one another. Hence, even if one were to put the appropriate grid pattern on the diffuser plate in question, the resultant apparatus would not operate in the intended manner. Hence, there is no reasonable expectation of success in making the alterations suggested by the Examiner. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 7 and 15.

6. Rejection of Claims 9, 10, 17, and 18 under 35 U.S.C. 103(a) as being unpatentable over Liou in view of Burns (US 5,442,147).

Claims 9 and 10 are dependent from Claim 1, and Claims 17 and 18 are dependent from Claim 11. These claims require that the detectable texture be on a semi-transparent layer that is overlaid over the illuminated surface. Applicant repeats the arguments made above with respect to the missing teachings in Liou with respect to Claims 1 and 11. The Examiner has not pointed to any teachings in Burns that provide the missing teachings. Hence, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 9, 10, 17 and 18.

Claims 10 and 18 further require that the semi-transparent layer provide unique positioning information that provides absolute position information for the apparatus relative to the illumination surface. The Examiner looks to Burns for the missing teachings. Applicant submits that the issue is not whether Burns teaches a semi-transparent layer with a unique pattern for absolute navigation, but whether such a pattern could be used in the apparatus of Liou and still have a functioning device. The apparatus taught by Liou requires a repetitive pattern, namely, a rectilinear grid having a specific relationship between the width of the dark and light regions, in order to function. The pattern in the layer taught by Burns would not comply with this requirement, and so the combination would not be operative.

Furthermore, to provide absolute position information, the pattern must change as one moves from position to position on the surface. However, the apparatus of Liou is incapable

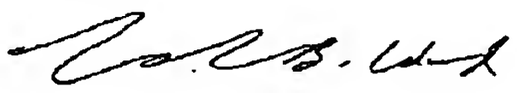
of detecting such changes. The apparatus of Liou only outputs 4 logic signals, two that provide an indication of the position in each dimension and the direction of motion since the last change in the state of the signals. Hence, the encoder of Liou is constrained to providing relative changes in position, and could not provide an absolute position indication without further alterations. Accordingly, there are additional grounds for allowing Claims 10 and 17.

VIII. CONCLUSION

Appellant respectfully submits that for the reasons of fact and law argued herein, the decision of the Examiner in finally rejecting Claims 1, 2, 4-11, 13-18, 20-21 should be reversed.

I hereby certify that this paper (along with any others attached hereto) is being sent via facsimile to fax number: 571-273-8300

Respectfully Submitted,



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APPENDIX

THE CLAIMS ON APPEAL:

1. An apparatus for optical navigation comprising:

a surface comprising an aperture, said surface configured to be moveable against an illuminated surface having a detectable texture;

an optical motion detection circuit integral to said apparatus and optically coupled to said detectable texture of said illuminated surface, said optical motion detection circuit comprising a single detector for acquiring images of said surface at a specified rate, said detector acquiring a single image at a time, and comprising an image processor producing motion signals indicative of motion of said surface relative to said detectable texture of said illuminated surface, wherein said motion signals are produced by comparing two said images and comprise a change in location in a first axis and a change in location in a second axis, wherein said optical motion detection circuit is operable to detect said detectable texture without requiring an integral illumination source.

2. The apparatus as recited in Claim 1 further comprising an optical element integral to said apparatus, said optical element proximate said aperture and receiving light from said detectable texture of said illuminated surface, said optical element operable to optically couple said optical motion detection circuit integral to said detectable texture of said illuminated surface.

4. The apparatus as recited in Claim 1 further comprising a supplemental light source operable to provide additional illumination onto said illuminated surface in response to said optical motion detection circuit detecting insufficient illumination of said illumination surface.

5. The apparatus as recited in Claim 1 further comprising an internal power source for providing power to said apparatus.

6. The apparatus as recited in Claim 1 wherein said illuminated surface is a cathode ray tube and wherein said detectable texture is a shadow mask of said cathode ray tube.

7. The apparatus as recited in Claim 1 wherein said illuminated surface is a liquid crystal display and wherein said detectable texture is a diffuser plate of said liquid crystal display.

8. The apparatus as recited in Claim 1 wherein said illuminated surface is a liquid crystal display and wherein said detectable texture comprises pixels of said liquid crystal display.

9. The apparatus as recited in Claim 1 wherein said illuminated surface is overlaid with a semi-transparent layer comprising said detectable texture.

10. The apparatus as recited in Claim 9 wherein said semi-transparent layer comprises unique positioning information providing absolute position information of said apparatus relative to said illuminated surface.

11. An electronic device for optical navigation on a display screen, said electronic device comprising:

a surface comprising an aperture, said surface configured to be moveable against a display screen having a detectable texture when illuminated;

an optical element integral to said electronic device, said optical element proximate said aperture and receiving light from said detectable texture when illuminated; and

an optical motion detection circuit integral to said electronic device and optically coupled by said optical element to said detectable texture of said display screen said optical motion detection circuit comprising an single detector for acquiring images of said surface at a specified rate, said detector acquiring a single image at a time, and comprising an image processor producing motion signals indicative of motion of said surface relative to said detectable texture of said display screen when illuminated, wherein said motion signals are

produced by comparing two said images and comprise a change in location in a first axis and a change in location in a second axis, wherein said optical motion detection circuit is operable to detect said detectable texture without requiring an integral illumination source.

13. The electronic device for optical navigation on a display screen as recited in Claim 11 further comprising an integral power source for providing power to said electronic device.

14. The electronic device for optical navigation on a display screen as recited in Claim 11 wherein said detectable texture is a shadow mask of a cathode ray tube.

15. The electronic device for optical navigation on a display screen as recited in Claim 11 wherein said detectable texture is a diffuser plate of a liquid crystal display.

16. The electronic device for optical navigation on a display screen as recited in Claim 11 wherein said detectable texture are pixels of a liquid crystal display.

17. The electronic device for optical navigation on a display screen as recited in Claim 11 wherein said display screen is overlaid with a semi-transparent layer comprising said detectable texture.

18. The electronic device for optical navigation on a display screen as recited in Claim 17 wherein said semi-transparent layer comprises unique positioning information providing absolute position information of said electronic device relative to said display screen.

20. A method for optical navigation on an illuminated surface using an electronic device, said method comprising:

acquiring a first frame from said illuminated surface at a single detector of said electronic device, such that said electronic device does not require an internal illumination source to provide illumination to said illuminated surface;

acquiring a second frame at said single detector from said illuminated surface:

determining a change in position in a first axis and in a second axis of said electronic device relative to said illuminated surface based on said first frame and said second frame,

wherein said determining a change in position comprises:

computing correlation values for said first frame and said second frame after said second frame has been shifted along one of said axes to determine an indication of movement of said electronic device from said first frame to said second frame;

predicting a shift in position from said first frame based on said correlation values: and

outputting a motion signal indicating said shift in position.

21. The method as recited in Claim 20 further comprising:

determining whether illumination provide by said illuminated surface sufficient for said acquiring said first frame; and

provided said illumination provided by said illuminated surface is not sufficient for said acquiring said first frame, providing additional illumination onto said illuminated surface.

22. A method for optical navigation on an illuminated surface using an electronic device, said method comprising:

acquiring a first frame from said illuminated surface at a single detector of said electronic device, such that said electronic device does not require an internal illumination source to provide illumination to said illuminated surface;

acquiring a second frame at said single detector from said illuminated surface;

determining a change in position in a first axis and in a second axis of said electronic device relative to said illuminated surface based on said first frame and said second frame;

wherein said determining a change in position comprises;

computing correlation values for said first frame and said second frame, said correlation values indicating movement of said electronic device from said first frame to said second frame;

predicting a shift in position from said first frame based on said correlation values; and

outputting a motion signal indicating said shift in position, said method further comprising:

determining whether illumination provided by said illuminated surface interferes with said acquiring said first frame; and

provided said illumination provided by said illuminated surface interferes with said acquiring said first frame, providing interference reducing illumination onto said illuminated surface; and

filtering said illumination such that said electronic device can acquire said first frame using said interference reducing illumination.

Evidence Appendix

none

Related Proceedings Appendix

none